AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR 2011

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT

PETER J. VISCLOSKY, Indiana, *Chairman*

CHET EDWARDS, Texas
ED PASTOR, Arizona
MARION BERRY, Arkansas
CHAKA FATTAH, Pennsylvania
STEVE ISRAEL, New York
JOHN W. OLVER, Massachusetts
LINCOLN DAVIS, Tennessee
JOHN T. SALAZAR, Colorado
PATRICK J. MURPHY, Pennsylvania

RODNEY P. FRELINGHUYSEN, New Jersey
ZACH WAMP, Tennessee
MICHAEL K. SIMPSON, Idaho
DENNIS R. REHBERG, Montana
KEN CALVERT, California
RODNEY ALEXANDER, Louisiana

NOTE: Under Committee Rules, Mr. Obey, as Chairman of the Full Committee, and Mr. Lewis, as Ranking Minority Member of the Full Committee, are authorized to sit as Members of all Subcommittees.

TAUNJA BERQUAM, JOSEPH LEVIN, JAMES WINDLE,
TYLER KRUZICH, and CASEY PEARCE, *Staff Assistants*

PART 6

DEPARTMENT OF ENERGY

Page
Environmental Management and Legacy Management **1**
Energy Efficiency and Renewable Energy, Fossil Energy, and Electricity Delivery and Energy Reliability **143**
Science and ARPA–E **353**

Printed for the use of the Committee on Appropriations

PART 6—ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR 2011

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR 2011

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE

COMMITTEE ON APPROPRIATIONS

HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

SECOND SESSION

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT

PETER J. VISCLOSKY, Indiana, *Chairman*

CHET EDWARDS, Texas
ED PASTOR, Arizona
MARION BERRY, Arkansas
CHAKA FATTAH, Pennsylvania
STEVE ISRAEL, New York
JOHN W. OLVER, Massachusetts
LINCOLN DAVIS, Tennessee
JOHN T. SALAZAR, Colorado
PATRICK J. MURPHY, Pennsylvania

RODNEY P. FRELINGHUYSEN, New Jersey
ZACH WAMP, Tennessee
MICHAEL K. SIMPSON, Idaho
DENNIS R. REHBERG, Montana
KEN CALVERT, California
RODNEY ALEXANDER, Louisiana

NOTE: Under Committee Rules, Mr. Obey, as Chairman of the Full Committee, and Mr. Lewis, as Ranking Minority Member of the Full Committee, are authorized to sit as Members of all Subcommittees.

TAUNJA BERQUAM, JOSEPH LEVIN, JAMES WINDLE,
TYLER KRUZICH, and CASEY PEARCE, *Staff Assistants*

PART 6

DEPARTMENT OF ENERGY

	Page
Environmental Management and Legacy Management	**1**
Energy Efficiency and Renewable Energy, Fossil Energy, and Electricity Delivery and Energy Reliability	**143**
Science and ARPA–E	**353**

Printed for the use of the Committee on Appropriations

U.S. GOVERNMENT PRINTING OFFICE
61–762 WASHINGTON : 2010

COMMITTEE ON APPROPRIATIONS

DAVID R. OBEY, Wisconsin, *Chairman*

NORMAN D. DICKS, Washington
ALAN B. MOLLOHAN, West Virginia
MARCY KAPTUR, Ohio
PETER J. VISCLOSKY, Indiana
NITA M. LOWEY, New York
JOSÉ E. SERRANO, New York
ROSA L. DeLAURO, Connecticut
JAMES P. MORAN, Virginia
JOHN W. OLVER, Massachusetts
ED PASTOR, Arizona
DAVID E. PRICE, North Carolina
CHET EDWARDS, Texas
PATRICK J. KENNEDY, Rhode Island
MAURICE D. HINCHEY, New York
LUCILLE ROYBAL-ALLARD, California
SAM FARR, California
JESSE L. JACKSON, Jr., Illinois
CAROLYN C. KILPATRICK, Michigan
ALLEN BOYD, Florida
CHAKA FATTAH, Pennsylvania
STEVEN R. ROTHMAN, New Jersey
SANFORD D. BISHOP, Jr., Georgia
MARION BERRY, Arkansas
BARBARA LEE, California
ADAM SCHIFF, California
MICHAEL HONDA, California
BETTY McCOLLUM, Minnesota
STEVE ISRAEL, New York
TIM RYAN, Ohio
C.A. “DUTCH” RUPPERSBERGER, Maryland
BEN CHANDLER, Kentucky
DEBBIE WASSERMAN SCHULTZ, Florida
CIRO RODRIGUEZ, Texas
LINCOLN DAVIS, Tennessee
JOHN T. SALAZAR, Colorado
PATRICK J. MURPHY, Pennsylvania

JERRY LEWIS, California
C. W. BILL YOUNG, Florida
HAROLD ROGERS, Kentucky
FRANK R. WOLF, Virginia
JACK KINGSTON, Georgia
RODNEY P. FRELINGHUYSEN, New Jersey
TODD TIAHRT, Kansas
ZACH WAMP, Tennessee
TOM LATHAM, Iowa
ROBERT B. ADERHOLT, Alabama
JO ANN EMERSON, Missouri
KAY GRANGER, Texas
MICHAEL K. SIMPSON, Idaho
JOHN ABNEY CULBERSON, Texas
MARK STEVEN KIRK, Illinois
ANDER CRENSHAW, Florida
DENNIS R. REHBERG, Montana
JOHN R. CARTER, Texas
RODNEY ALEXANDER, Louisiana
KEN CALVERT, California
JO BONNER, Alabama
STEVEN C. LaTOURETTE, Ohio
TOM COLE, Oklahoma

Beverly Pheto, *Clerk and Staff Director*

ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR 2011

TUESDAY, MARCH 16, 2010.

DEPARTMENT OF ENERGY: ENVIRONMENTAL MANAGEMENT, LEGACY MANAGEMENT, FY2011 BUDGET

WITNESSES

INES TRIAY, ASSISTANT SECRETARY FOR ENVIRONMENTAL MANAGEMENT

DAVID GEISER, ACTING DIRECTOR, OFFICE OF LEGACY MANAGEMENT

Mr. PASTOR [presiding]. The committee will come to order. Good afternoon.

We have before us today Dr. Ines Triay, assistant secretary for environmental management, and she is accompanied by Mr. David Geiser, acting director of the Office of Legacy Management. They will be presenting and defending—I added that—presenting and defending the president's fiscal year 2011 budget request for the Office of Environmental Management and Legacy Management.

The environmental management program has operated since 1989. It has a difficult mission of cleaning up the legacy of the nation's nuclear weapons complex and other nuclear research activities. Fiscal year 2011 request for environmental management is $6.3 billion, $118 million less than fiscal year 2010.

This work includes defense and non-defense clean-up work, as well as clean-up at the nation's uranium enrichment facilities. The legacy management budget request is $189 million, nearly the same as last year, to take over the management of the sites as they cross the clean-up finish line.

Dr. Triay, I know and appreciate your aggressive efforts to improve the way you do business, but we have to do better in terms of project management. And as I read your testimony, I think you have dealt with that.

With billions of dollars invested every year, we need to see results. We are very interested in hearing your progress and plans.

Mr. Geiser, you will inherit these sites when the clean-up has been completed, and we look forward to your view on your mission and the challenges you are facing in the future.

I also ask that, if members have additional questions, that they would submit them for the record, that they please do so to the subcommittee by 5 p.m. tomorrow. I imagine that we will forward some of these questions to you. We have a time for response of 4 weeks, if you could do that for us.

With these opening comments, I would like to yield to our ranking member for any opening comments that he would like to make.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman.

Good afternoon, Madam Secretary. Welcome.

Mr. Geiser, thank you both for your first appearance before our committee.

The administration's budget, as the chairman has said, for environmental management and legacy management is $6.6 billion, roughly 1 percent more than last year's appropriations. My constituents are increasingly alarmed by the growing deficit and the growing government bureaucracy, so I am gratified to see that the growth in your program is being kept under control.

However, your fiscal year 2011 budget will be in addition to the $6 billion your program received in the stimulus act, AKA Recovery Act, nearly a full year's regular appropriation.

I think it is fair to say that Congress expects to see significant progress with the funding already provided to it, and I am sure you will run over those figures pretty comprehensively this afternoon.

Madam Secretary, while we all like to see—we all like to see our environmental clean-up programs move ever more quickly, you made great progress in implementing your stimulus act funding. Much of the progress made is directly due to your leadership. And I must say, I am encouraged—and I am sure as all members are—to have such a great career professional in your position.

Too many of your predecessors have run their programs—if you will pardon the expression—like science projects, bypassing the sure for the innovative. Environmental Management's mandate is to clean up the environmental legacy of our nation's nuclear weapons programs and, in doing so, use taxpayer's money efficiently and effectively, and I am sure you are doing just that.

Mr. Geiser, when addressing clean-up, the reputation of the department often rests on the good relations it has with its neighbors. The work of you and your people to maintain our sites once they are cleaned are critical to that reputation. You help provide the secretary with the clarity of mission we are counting on to get the job done.

So all of us are looking forward to your testimony, and I thank you, Mr. Chairman.

Mr. PASTOR. Thank you.

Assistant Secretary.

Ms. TRIAY. Good afternoon, Mr. Chairman and Ranking Member, and Members of the Subcommittee.

I am pleased to be here today and to address your questions regarding the Office of Environmental Management's fiscal year 2011 budget request. The Office of Environmental Management's mission is to complete the legacy environmental clean-up left by the Cold War in a safe, secure and compliant manner.

I am very pleased that we are able to present to Congress a budget, that positions the program to be fully compliant with our regulatory commitments and support reducing the risks associated with one of our highest environmental risk activities, tank waste, as well as achieve footprint reduction across the legacy clean-up complex.

My goal remains to complete quality clean-up work safety, on schedule, and within cost, in order to deliver demonstrated value to the American taxpayer. Environmental Management clean-up objectives will continue to be advanced in fiscal year 2011 by the infusion of $6 billion from the American Recovery and Reinvestment Act of 2009.

Through January 2010, the Office of Environmental Management has obligated $5.7 billion and spent $1.1 billion. Today, we are at $1.55 billion, leading to thousands of jobs created and/or saved at our sites. In fiscal year 2011, we estimate that $2.4 billion in Recovery Act funding will be spent to support the Office of Environmental Management clean-up objective, and our objective is to have spent $3.5 billion of Recovery Act funding by August of this calendar year.

In fiscal year 2011, the Office of Environmental Management will continue to draw on the $6 billion of Recovery Act funds to advance key clean-up goals. Recovery Act funds allow the Office of Environmental Management to meet all of our regulatory compliance requirements in fiscal year 2011.

This funding has also allowed the Office of Environmental Management to leverage base program dollars, enabling the reduction of our operating footprint from 900 square miles to approximately 540 square miles by the end of fiscal year 2011. This is a 40 percent reduction which will position the program to advance forward the ultimate goal of 90 percent reduction by the end of fiscal year 2015.

We are also able to accelerate the legacy clean-up at Brookhaven National Laboratory, the Separations Process Research Unit in New York, and Stanford Linear Accelerator Center in California into fiscal year 2011 with the Recovery Act funding.

This budget request strikes a balance between maintaining support for the Office of Environmental Management's core commitments and programs, while strengthening investments in activities needed to ensure the long-term success of our clean-up mission. This budget request significantly increases the Office of Environmental Management's investment in science and technology areas that are critical to our long-term success.

Specifically, this request targets $60 million in funding the Hanford Office of River Protection for use in developing and deploying new technologies for treating tank waste. This funding is needed to address near-term technical risks that have been identified, but is also needed to leverage and bring forward new technologies that could help us mitigate the life cycle clean-up of this waste.

The Office of Environmental Management will also continue to strengthen and deploy groundwater decontamination and decommissioning clean-up technologies. Specifically, we will continue the development of an integrated high-performance computer modeling capability for waste degradation and contaminant release.

This state-of-the-art scientific tool would enable robust and standardized assessments of performance and risk for clean-up and closure activities. This tool will also help us better estimate clean-up time and costs, and reduce uncertainties.

The request also provides an additional $50 million to accelerate the Waste Treatment and Immobilization Plant at Hanford, boosting the budget for the plant to $740 million in fiscal year 2010. The additional funding will be used to accelerate completion of the design for the Waste Treatment and Immobilization Plant.

Prior to design completion, it is critical that technical issues are addressed and incorporated in a timely manner. Our intent is to mitigate these risks early and get the design matured to 90 or 100 percent.

The fiscal year 2011 request makes a significant investment in the decontamination and the decommissioning of the Portsmouth Gaseous Diffusion Plant located in Ohio. This investment enables the Office of Environmental Management to accelerate the clean-up of the Portsmouth site by 15 to 20 years, leading to a significant reduction in the duration and the cost of the clean-up.

Now that I have given an overview of our fiscal year budget request, I would like to take a few moments to discuss some of the areas I will be focusing on as the program moves forward.

The Office of Environmental Management continues to adhere to a safety first culture that integrates environment, safety and health requirements and controls into all work activities. Our first priority continues to be the health and safety of our employees and the communities surrounding our clean-up sites. It is my duty to ensure that our workers go home as healthy and fit as they came to work.

Under my leadership, the program has embarked upon a "journey to excellence." We have developed a new Business Model which provides us a solid management base for the Office of Environmental Management to become an excellent high-performing organization. This implementation is key to performing our clean-up mission effectively and efficiently.

A key component in this process is the alignment and understanding of headquarters and field operational roles and responsibilities. Toward that end, we will continue to focus on improving project management, performance, aligning project and contract management, streamlining the acquisition process, and continue on our very strong performance in awarding clean-up work to small businesses.

We will continue to conduct construction project reviews. These reviews examine all aspects of our construction projects, including project management, technology, and engineering. These reviews assess the progress of each of our major projects and determine the overall health and ability to meet cost and schedule goals.

These reviews are scheduled approximately every 6 to 9 months and are conducted to provide the Office of Environmental Management the ability to proactively reduce project risks so that issues and solutions can be identified early, rather than react, once problems are realized.

With these improvements, we are confident that the Environmental Management Program can succeed in its mission.

Mr. Chairman, Ranking Member, and Members of the Subcommittee, I look forward to addressing your questions.

[The information follows:]

Statement of Inès Triay
Assistant Secretary for Environmental Management
United States Department of Energy
Before the Subcommittee on Energy and Water Development
Committee on Appropriations
United States House of Representatives

March 16, 2010

Good morning, Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Subcommittee. I am pleased to be here to today to answer your questions on the President's Fiscal Year (FY) 2011 budget request for the Department of Energy's (DOE) Office of Environmental Management (EM).

Program Status

In FY 2011, EM will continue to build on over 20 years of cleanup progress and will focus on investments to sustain risk reduction and strengthen technology. EM has made substantial progress in nearly every area of nuclear waste cleanup, including stabilizing and consolidating high-risk material such as tank waste and surplus special nuclear material (SNM). Progress also includes the near completion of transferring spent nuclear fuel (SNF) from wet to dry storage and disposing of large quantities of transuranic (TRU) waste, low-level waste (LLW), and mixed low-level waste (MLLW). Much work remains but demonstrable progress has been made.

EM will continue to seek ways to maximize reduction of environmental, safety, and health risks in a safe, secure, compliant, and cost-effective manner. The current EM life-cycle cost (LCC) estimate range, which covers the period of 1997 through completion, is $275 to $329 billion. This includes $82 billion in actual costs from 1997 through 2009, and an additional estimate of $193 to $247 billion to complete EM's remaining mission.

EM is analyzing its project plans to further optimize the program. This strategic planning effort will concentrate on the technical, programmatic, and performance challenges facing the cleanup projects. It is focused on footprint reduction and near-term completions to reduce monitoring and maintenance costs and on alternative approaches to disposition tank waste and surplus SNM and SNF.

EM cleanup objectives will continue to be advanced in FY 2011 by the infusion of $6 billion from the American Recovery and Reinvestment Act of 2009 (Recovery Act). Through January, 2010, EM has obligated $5.8 billion and spent $1.1 billion, respectively leading to thousands of jobs created and/or saved at the EM sites. The Recovery Act funding is being used to further drive the EM footprint reduction of 40 percent by September 2011, removal of 2 million tons of mill tailings at the Moab site, accelerate by seven years the disposition of legacy TRU waste inventories at 11 sites, and build out the infrastructure needed to support high-level waste processing operations. EM will use Recovery Act funding to accelerate legacy cleanup completion at three small sites: the

Brookhaven National Laboratory and Separations Process Research Unit in New York; and the Stanford Linear Accelerator Center in California. EM will continue to build on its success in utilizing small businesses to advance its cleanup objectives. In FY 2009, EM obligated $697 million of Recovery Act funding and $1.6 billion of base program funding for a total of $2.3 billion awarded to small businesses.

Program Strategies

EM continues to adhere to a "Safety First" culture that integrates environment, safety, and health requirements and controls into all work activities. EM's goal is to keep our employees, the public, our stakeholders, and the states where cleanup sites are located safe from radioactive and hazardous materials contamination. EM plans to continue improving safety performance by further integrating safety into all work activities and by incorporating requirements and controls into every project, with the goal of achieving zero accidents or incidents.

EM's vision is to complete quality work safely, on schedule, and within cost in order to deliver demonstrated value to the American taxpayer. EM is introducing a new Business Model/Approach to achieve this vision. In addition to the safety performance goal, mentioned above, EM's new approach includes improving Project Management through restructuring the project portfolio, adapting the Office of Science construction project review model to EM projects, establishing performance metrics for EM operating projects, aligning project and contract management, and streamlining the acquisition process. EM is aligning Headquarters and Field Operations in order to streamline decision-making and improve efficiency. We plan to utilize science and technology to optimize the efficiency of tank waste, surplus SNM, SNF, and groundwater treatment and disposition. Through these changes, EM plans to achieve excellence in management and leadership with the objective of making EM the employer of choice in the federal government.

EM will continue to conduct construction project reviews. These reviews examine all aspects of a construction project, including project management, technology, design, engineering, safety, environment, security, and quality assurance. The process relies on expert knowledge and experience of world-class engineers, scientists, and managers sourced from federal staff, DOE contractors, engineering firms, national laboratories, and the academic community. These reviews assess the progress of each of its major projects and determine their overall health and ability to meet cost and schedule goals. Scheduled approximately every six to nine months, these reviews are intended to reduce the risk of project failure by identifying existing and potential concerns in a timely manner. In FY 2009, all five major construction projects were reviewed with the findings ranging from technical to financial. In FY 2010, EM plans to conduct up to 10 reviews of its major projects and other capital asset projects, as needed, to follow up on previous findings and continue to assess the ability of the project to meet its scope, schedule and cost objectives. As such, these reviews will provide EM leadership an "early warning" of possible problems so that corrections can be made.

Highlights of FY 2011 Request

EM's overarching goal is to complete the cleanup of the legacy of the Cold War in a safe, secure, and compliant manner, on schedule and within budget. EM will continue to pursue its cleanup objectives and regulatory commitments, overlaying risk reduction and best business practices. In FY 2011, EM is well positioned to meet its regulatory compliance milestones.

In FY 2011, EM intends to reduce its operation footprint from 900 square miles to approximately 540 square miles, a 40 percent reduction, with the goal of achieving a 90 percent reduction by 2015. In FY 2011, EM will also complete the legacy cleanup at Brookhaven National Laboratory and the Separations Process Research Unit in New York, and at the General Electric Vallecitos Nuclear Center and Stanford Linear Accelerator Center in California.

EM's cleanup priorities have not changed and we remain committed to:

- Activities to maintain safe, secure, and compliant operations within the EM complex
- Radioactive tank waste stabilization, treatment, and disposal
- SNF storage, receipt, and disposition
- SNM consolidation, processing, and disposition
- High priority groundwater remediation
- TRU waste and MLLW/LLW disposition
- Soil and groundwater remediation
- Excess facilities decontamination and decommissioning (D&D)

EM's FY 2011 budget request funds radioactive liquid tank waste activities that are a large part of the cleanup challenge EM faces at its Hanford, Savannah River and Idaho sites allowing the program to progress on its tank waste retrieval commitments and fund construction on tank waste treatment facilities. The request also targets $60 million in funding for Hanford's Office of River Protection to invest in developing technology that can be inserted into the project's schedule that can yield significant cost savings and reduce the period of execution. Specifically, this funding will be utilized to solve near-term technical risks that have been identified and used to leverage and bring forth new technologies by focusing on such critical areas as: waste chemistry issues associated with characterization and separation; and advanced retrieval technologies. EM will continue to coordinate with the DOE Office of Science, national laboratories, and other federal and private organizations to address technology gaps in tank waste processing technologies.

The request also provides an additional $50 million to accelerate completion of the design of the Waste Treatment and Immobilization Plant (WTP) at Hanford—boosting the budget for the plant in FY 2011 to $740 million. This funding will enable the acceleration of design and focus on mitigating project risks early and getting the design matured to 90 or 100 percent as quickly as possible.

EM will also continue to strengthen and deploy groundwater and D&D cleanup technologies as they are vital to the long-term success of our mission. Specifically, EM will continue the development of an integrated, high-performance computer modeling capability for waste degradation and contaminant release. This state-of-the-art scientific tool will enable robust and standardized assessments of performance and risk for EM cleanup and closure activities. This tool will also help EM better estimate cleanup time and costs, and reduce uncertainties and risks associated with subsurface contaminant behavior and transport processes.

Finally, the FY 2011 request significantly increases the funding for D&D at the Portsmouth Gaseous Diffusion Plant to accelerate the D&D cleanup. This increase at Portsmouth provides the opportunity for EM to significantly reduce the overall LCC and period of execution associated with cleanup at the Portsmouth site by 15 to 20 years.

FY 2011 Budget Request

The Department's FY 2011 budget request for EM is $6.05 billion, of which $5.59 billion is for defense environmental cleanup activities, $225 million is for non-defense environmental cleanup activities, and $730 million is for Uranium Enrichment Decontamination and Decommissioning Fund. Examples of planned activities and milestones for FY 2011 by site-specific categories are:

Idaho

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$489,239	$467,875	$411,168	$469,168	$412,000

- *Complete construction and readiness testing in preparation for startup of operations of the Sodium Bearing Waste Facility.*

  The Sodium Bearing Waste Treatment Project supports DOE's EM mission of safely storing and treating liquid radioactive wastes. This project will treat approximately 900,000 gallons of sodium bearing waste stored in tanks that are 35 to 45 years old. The treatment of this waste will enable EM to meet the Notice of Noncompliance – Consent Order Modification to cease use of the Tank Farm Facility by December 31, 2012. In FY 2011, the Sodium Bearing Waste facility construction and readiness testing will be complete.

- *Ship CH-TRU waste to WIPP, and dispose of MLLW and LLW, as required in the 1995 Idaho Settlement Agreement.*

During FY 2011, 5,700 cubic meters of CH-TRU waste will be shipped to WIPP for disposal. In addition, 2,050 cubic meters of MLLW/LLW will be shipped for disposal by September 2011.

Los Alamos National Laboratory

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$226,082	$211,775	$191,938	$199,438	$200,000

- *Continue characterization and certification of TRU waste for shipment to WIPP.*

  The Solid Waste Stabilization and Disposition Project is comprised of the treatment, storage, and disposal of legacy TRU waste and MLLW generated between 1970 and 1999 at Los Alamos National Laboratory (LANL). The end-state of this project is the safe disposal of legacy waste at LANL. In FY 2011, LANL plans to package 2,000 drum equivalents of TRU waste for disposition, support up to three shipments a week to WIPP, and disposition of up to 300 cubic meters of LLW.

- *Maintain soil and water remediation.*

  The LANL Soil and Water Remediation Project scope includes identification, investigation, and remediation of chemical and/or radiological contamination attributable to past Laboratory operations and practices. The remaining scope of the project includes characterization, monitoring, and protection of the surface and groundwater at the Laboratory and approximately 860 Potential Release Sites left to be investigated, remediated or closed by evaluation and assessment of human health and ecological risks. In FY 2011, activities include completion of characterization activities for Upper Cañada del Buey, Two Mile, and Canyon de Valle Aggregate Areas.

Moab

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$40,699	$108,350	$30,671	$39,000	$31,000

- *Continue to accelerate hauling of mill tailings from the Moab site.*

The project scope is to remediate contaminated mill tailings, mill debris, contaminated groundwater, and contaminated vicinity properties at the former Atlas Minerals Corporation uranium ore-processing site. In FY 2011, Moab will continue tailings excavation and transport from the mill site to the disposal cell and continue placing tailings into the disposal cell and constructing the cell cover.

Oak Ridge

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$498,688	$755,110	$411,168	$436,168	$450,000

- *Continue design for construction of annex and Building 3019 modifications for the Uranium-233 (U-233) down-blending process.*

  The Oak Ridge National Laboratory maintains the Department's inventory of U-233 which is currently stored in Building 3019. The FY 2011 funding request will support the completion of 90 percent design for construction of annex and building 3019 modifications in preparation for future disposal. Benefits include reducing safeguards and security requirements and eliminating long-term worker safety and criticality concerns.

- *Continue D&D of facilities and remedial actions at the East Tennessee Technology Park (ETTP).*

  ETTP was originally built as a uranium enrichment facility for defense programs. The D&D of K-25, the former gaseous diffusion process-building within ETTP, is the top priority because of worker safety concerns stemming from the deteriorating condition of the building. In FY 2011, activities include: maintain ETTP in a safe and secure condition and continue demolition activities in preparation for demolition of the East Wing and North End of the K-25.

Paducah

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$169,947	$78,800	$144,857	$172,127	$145,000

- *Complete operational readiness review and begin operation of the Depleted Uranium Hexafluoride (DUF6) Conversion Facility.*

The DUF6 Conversion Facility converts depleted uranium hexafluoride into a more stable form of depleted uranium oxide suitable for reuse or disposition. The depleted uranium oxide will be sent to a disposal facility, and the hydrogen fluoride co-products will be sold on the commercial market. In FY 2011, activities include: complete the operational readiness review; commence safe operation of the DUF6 Project Conversion facilities; and package 7,750 metric tons of depleted uranium for disposition.

Portsmouth

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$240,715	$118,200	$319,663	$303,307	$479,035

- *Begin operation of the DUF6 Project conversion facilities and dispose of uranium oxide and hydrofluoric acid.*

  The DUF6 Conversion Facility converts depleted uranium hexafluoride into a more stable form of depleted uranium oxide suitable for reuse or disposition. The depleted uranium oxide will be sent to a disposal facility, and the hydrogen fluoride co-products will be sold on the commercial market. In FY 2011, activities include: commence safe operation of the DUF6 Project Conversion facilities; and package 9,800 metric tons of depleted uranium for disposition.

- *Accelerate D&D of gaseous diffusion plant facilities and systems.*

  The scope of this project encompasses remedial actions due to contamination resulting from the Portsmouth Gaseous Diffusion Plant's historical uranium enrichment operations, inactive facility D&D, and surveillance and maintenance activities at the Plant. FY 2011 activities include: begin increased level of D&D of gaseous diffusion plant ancillary facilities and systems; and initiate process building equipment removal actions, hazardous materials abatement and other deactivation activities. These efforts enable the reduction of the time span of this work by 15 to 20 years.

Richland

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$1,057,496	$1,634,500	$993,503	$1,080,503	$1,041,822

- *Continue remediation and facility D&D within the River Corridor.*

  In FY 2011, cleanup activities in the River Corridor include: complete excavation of three of five 100-H burial grounds; complete 22 interim remedial actions at the 100 B/C Area; complete disposition of eight facilities; and initiate interim safe storage of the 105-KE Reactor and D4 100K Area facilities. These efforts will assist in reducing the Richland site footprint by up to 40 percent in 2011.

- *Maintain base operations to treat and dispose of LLW, MLLW, and TRU waste, as well as, ship CH-TRU waste to WIPP for disposal.*

  In FY 2011, activities include: provide core management and base operations to store, treat, and disposition LLW, MLLW, and TRU waste at the Central Waste Complex and manage off-site commercial MLLW waste treatment/disposal contracts; provide base operations of disposal trenches for Hanford's MLLW; provide the base operations necessary to store and treat MLLW and TRU waste at the T Plant Complex; and to ship up to 1,825 cubic meters of CH-TRU waste.

River Protection

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$1,009,043	$326,035	$1,098,000	$1,098,000	$1,158,178

- *Manage the tank farms in a safe and compliant manner until closure.*

  The radioactive waste stored in the Hanford tanks was produced as part of the nation's defense program. In order to protect the Columbia River, the waste must be removed and processed to a form suitable for disposal and the tanks stabilized. To accomplish these goals, in FY 2011, activities include: complete two 242-A Evaporator Campaigns for space management; complete retrieval of two C-Farm Single-Shell Tanks; complete removal of six hose-in-hose transfer lines; initiate C-200 Closure Demonstration Project; and continue to perform single-shell tank integrity evaluations.

- *Continue construction of the WTP complex.*

  WTP is critical to the completion of the Hanford tank waste program by providing the primary treatment capability to immobilize (vitrify) the radioactive tank waste at the Hanford Site. The WTP complex includes five major facilities: Pretreatment Facility, High-Level Waste Facility, Low-Activity Waste Facility, Analytical Laboratory, and the Balance of Facilities. In FY 2011, activities include: complete vessel upgrades for three spent resin collection and dewatering vessels to incorporate revised seismic assessment criteria at the Pretreatment Facility; complete civil engineering design (Title II) and Architectural design at the High-Level Waste Facility; complete 80 percent of bulk process piping installation and 65 percent of bulk conduit installation at the Low-Activity Waste Facility; complete 90 percent of bulk piping installation at the Analytical Laboratory; and accept delivery of the Anhydrous Ammonia System at the Balance of Facilities.

Savannah River Site

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$1,361,479	$1,615,400	$1,342,013	$1,342,013	$1,349,863

- *Continue consolidation and disposition of SNM.*

  The receipt, storage, and disposition of materials at SRS allows for de-inventory and shutdown of facilities at other DOE complex sites, providing substantial risk reduction and significant mortgage reduction savings to the Department. In FY 2011, activities include: Savannah River Site (SRS) continue to receive weapons grade surplus non-pit plutonium from LANL and Lawrence Livermore National Laboratory; develop a program to reduce the risk to personnel and the environment by reducing the residual plutonium-238 contamination in the F Area Materials Storage Facility (235-F); continue processing nuclear materials as well as purchase of cold chemicals and other materials for operations of H Canyon and HB Line; support L to H shipments to H Canyon; and perform H Canyon/HB Line infrastructure upgrades.

- *Reduce radioactive liquid waste.*

  The mission of the tank waste program at SRS is to safely and efficiently treat, stabilize, and dispose of approximately 37 million gallons of legacy radioactive waste currently stored in 49 underground storage tanks. In FY 2011, activities include: continue operation of interim salt processing facilities; support H Canyon receipts of newly generated waste; continue operation of the Defense Waste Processing Facility and complete 297 canisters of glass waste; continue construction of the Salt Waste Processing Facility; continue saltstone production and disposal operations as well as vault construction; and support Tank 48 Return to Service Project.

WIPP

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$236,785	**$172,375**	**$224,981**	**$234,981**	**$225,000**

- *Operate WIPP in a safe and compliant manner and dispose of CH and remote-handled (RH) TRU waste from 27 DOE sites.*

  WIPP in Carlsbad, New Mexico, is the nation's only mined geologic repository for the permanent disposal of defense-generated TRU waste. In FY 2011, the budget request supports maintaining an average shipping capability of 21 CH and 5 RH-TRU waste shipments per week. In addition WIPP will increase characterization efforts at TRU waste generator sites to increase inventory of shippable waste and increase WIPP's efficiency.

Conclusion

Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Subcommittee, I am honored to be here today representing the Office of Environmental Management. My program continues to pursue its cleanup objectives within the overall framework of achieving the greatest risk reduction benefit per radioactive content and overlaying regulatory compliance commitments and best business practices to maximize cleanup progress. We do that by continuing to address our highest priority cleanup activities in FY 2011 while using Recovery Act funding to continue making progress on the twin goals of life-cycle cost management and footprint reduction. We are also integrating other equally important strategies into the cleanup activities so that we may complete quality work safely, on schedule and within cost thereby delivering demonstrated value to the American taxpayer.

I am pleased to answer any questions you may have.

Mr. GEISER. Good morning, Mr. Chairman, Ranking Member Frelinghuysen, and distinguished members of the committee.

The department created Legacy Management 7 years ago to provide a long-term, sustainable solution to the legacy of the Cold War. Congress supported the creation of this office in fiscal year 2004, recommended merging the Office of Worker and Community Transition and the legacy components of the Office of Environmental Management.

With Legacy Management having the lead for post-closure responsibilities, the department is better positioned to focus its major programs and personnel on continuing missions. Legacy Management's mission is to manage the department's post-closure responsibilities and ensure the future protection of human health and the environment.

Fiscal year 2011 budget request is $189 million. The request is tied directly toward achieving our core mission and goals. Our primary goals are to protect human health and the environment through effective and efficient long-term surveillance and maintenance, preserve, protect, and make accessible legacy records and information, to assure contractor worker pension and medical benefits, and to manage legacy lands and assets, emphasizing protective, real and personal property reuse and disposition of property.

We are requesting $36 million to protect human health and the environment at and near our legacy sites. An essential component of our mission is to ensure that environmental remedies are effective and that we are in compliance with environmental regulations.

At the end of fiscal year 2009, Legacy Management was responsible for 85 sites that had played a role in the nation's nuclear weapons production effort. Our site responsibility is current distributed across 28 states, and ranges from the Aleutian Islands to Puerto Rico.

In conducting this mission, Legacy Management has developed a strong reputation for working closely and effectively with our stakeholders, regulators, representatives from local and state governments, and tribal nations.

We are requesting $11 million to manage legacy records. Integral to the clean-up and closure of sites is the preservation, protection and public access to records and electronic information. Our office now manages more than 100,000 cubic feet of physical records and a large amount of electronic information.

We expect to process over 2,000 requests for information under the Privacy Act, Freedom of Information Act, Energy Employees Occupational Illness Compensation Program Act, and other inquiries.

We are requesting $122 million to support post-closure contractor responsibilities. Specifically, the Legacy Management request provides for continuity of either pensions or post-retirement benefits or both for over 14,000 former contractor workers. Those workers are associated with the following sites: Rocky Flats, Fernald, Mound, Penellis, Grand Junction, Portsmouth, and Paducah.

Under Legacy Management oversight, the contractor pension plan assets have increased, and the volatility has been reduced through a more conservative investment approach.

We are requesting $6 million for property management and beneficial reuse. One of our goals is to enable beneficial reuse of our sites while still ensuring the protection of human health and the environment. Where possible, we may make land and facilities available for government, public or private use. Currently, Legacy Management has almost 4,000 of our 13,000 acres in reuse. Types of reuse include conservation, industrial activity, community infrastructure, grazing, and forestry.

In closing, the secretary is committed to ensuring that the department meets our post-closure responsibilities. This includes the protection of human health and the environment, access to records and information, meeting our commitments to former contractor workers, and maximizing the beneficial reuse of properties no longer needed for departmental missions.

Thank you for the opportunity to be here today to provide testimony on this important program.

[The information follows:]

STATEMENT OF

DAVID GEISER
DIRECTOR, OFFICE OF LEGACY MANAGEMENT
DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT
COMMITTEE ON APPROPRIATIONS
UNITED STATES HOUSE OF REPRESENTATIVES

MARCH 16, 2010

Good morning Mr. Chairman, and distinguished members of the committee. My name is Dave Geiser and I am the Director of the Office of Legacy Management (LM) at the Department of Energy (DOE). LM is responsible for ensuring that DOE's post-closure responsibilities are met by providing: long-term surveillance and maintenance of environmental remedies; access to historical records and information; contractor benefits continuity; and, beneficial reuse of Federal property no longer needed for Departmental missions.

OPENING REMARKS

The Department created LM seven years ago to provide a long-term, sustainable solution to the legacy of the Cold War. Congress supported the creation of this office in Fiscal Year 2004 and recommended merging the Office of Worker and Community Transition (WT) with the legacy components of the Office of Environmental Management (EM). With LM having the lead for post closure responsibilities, the Department is better positioned to focus its major programs and personnel on continuing missions. Independent operation by LM allows the Assistant Secretary for EM to concentrate on the remaining site cleanup activities and risk reduction.

LEGACY MANAGEMENT MISSION AND GOALS

LM's mission is to manage the Department's post-closure responsibilities and ensure the future protection of human health and the environment. LM's primary goals are:

- Protect human health and the environment through effective and efficient long-term surveillance and maintenance;
- Preserve, protect, and make accessible legacy records and information;
- Support an effective and efficient work force structured to accomplish the Department's missions and assure contractor worker pension and medical benefits; and,
- Manage legacy land and assets, emphasizing protective real and personal property reuse and disposition.

LEGACY MANAGEMENT FISCAL YEAR 2011 FUNDING REQUEST

The Fiscal Year 2011 budget request for LM is $189 million; the request is tied directly to achieving our core mission and goals. The majority of the request ($122 million) will fund contractor pension plans and post retirement benefits for over 14,000 retired contractor workers. The budget includes $36 million to protect human health and the environment at DOE legacy sites and $11 million to preserve, protect, and make accessible legacy records. Managing legacy lands and assets will require about $6 million. Approximately $1 million will be used to manage the Department's environmental justice program and $13 million will be used to cover the cost of federal salaries, training, and travel.

(Dollars in thousands)

FY 2009 Appropriation	FY 2009 Recovery Act	FY 2010 Request	FY 2010 Appropriation	FY 2011 Request
$185,981	$0	$189,802	$190,802	$188,626

LONG-TERM SURVEILLANCE AND MAINTENANCE

We are requesting $36 million to protect human health and the environment at, and near, our legacy sites. An essential component of our mission is to ensure that environmental remedies at all sites are effective and that we are in compliance with environmental regulations. This is the Department's commitment to address the environmental legacy responsibilities associated with the activities of the Department and predecessor agencies during World War II and the Cold War. In conducting this mission, LM has developed a strong reputation for working closely and effectively with our stakeholders, regulators, and representatives from local and state governments, and Tribal Nations.

At the end of Fiscal Year 2009, LM was responsible for 85 sites that had played a role in the Nation's nuclear weapons production effort. Our site responsibility is currently distributed across 28 states, and ranges from the Aleutian Islands to Puerto Rico. As a result of past cleanup efforts, many of these former nuclear weapons production sites serve as wildlife refuges and nature preserves or support private sector commercial activities.

LM has made steady progress in our ability to manage increased program responsibilities while meeting the President's goals for reducing costs and increasing efficiency. LM's site responsibility is expected to grow to 95 sites by the end of this Fiscal Year and to 109 sites by the end of Fiscal Year 2015. This growth includes sites remediated by the U.S. Army Corp of Engineers (the Formerly Utilized Sites Remedial Action Program), former uranium-milling sites after cleanup by their current owners, and sites managed by EM. The next major site to be transferred from EM is the former Mound Plant in Miamisburg, Ohio. The formal site transition is scheduled for October 1, 2010. We have continued to work closely with our colleagues in EM to ensure a seamless handoff of site responsibilities.

LEGACY RECORDS

We are requesting $11 million to manage legacy records. Integral to the cleanup and closure of sites is the preservation, protection, and public access to records and electronic information. Our records include historical site records, cleanup and long-term surveillance and maintenance records, and former contractor personnel and medical records.

LM now manages more than 100,000 cubic feet of physical records and a large amount of electronic information. In addition to the physical records collection, LM will manage a smaller collection of special media that includes x-rays, photographs and negatives, video and audio tapes, and architectural drawings that require special environmental controls. LM expects to process over 2000 requests for information under the Privacy Act, Freedom of Information Act, Energy Employees Occupational Illness Compensation Program Act, and other inquires.

In December 2009, we started to consolidate our records management operations at the LM Business Center in Morgantown, West Virginia. This facility, constructed by the General Services Administration, is National Archives and Records Administration (NARA) 2009 compliant and will house LM's records collection and meet our requirements for managing electronic information. We have applied for, and hope to receive, the U.S. Green Building Council's "Gold" Leadership in Energy and Environmental Design (LEED) certification for this facility.

MANAGEMENT OF POST-CLOSURE CONTRACTOR RESPONSIBILITIES

We are requesting $122 million to support post-closure contractor responsibilities. Specifically, the LM request provides for continuity of pensions and post-retirement benefits for over 14,000 former contractor workers. Those former contractor workers are associated with the following sites: Rocky Flats, Fernald, Mound, Pinellas, Grand Junction, Portsmouth and Paducah. Under LM oversight, the contractor pension plan assets have increased and the volatility has been reduced through a more conservative investment approach.

PROPERTY AND BENEFICIAL REUSE

We are requesting $6 million for property management and beneficial reuse. One of LM's goals is to enable beneficial reuse of our sites while still ensuring the protection of human health and the environment. Where possible, LM makes land and facilities available for government, public, and private use consistent with the tenets of sustainability and good land management practices. Currently LM has almost 4000 of our 13,000 acres in reuse. The types of reuse under consideration include: disposition (the preferred reuse option), conservation, commercial and industrial activity, community infrastructure, grazing, and forestry.

LM has responsibility for several sites where conservation is a priority. The 1,300 acre Rocky Flats site in Colorado is largely surrounded by 4000 acres transferred by the Department to the U. S. Fish and Wildlife Service. The natural features of the 1050 acre Fernald Preserve in Ohio have been restored and include upland forests, open water, the beginnings of a tall grass prairie and a 10,000-square foot, LEED Platinum-certified Visitors Center. The Weldon Spring Site in Charles County, MO has been enhanced for both recreation and education including a hike-and-bike trail and a 9,000 square foot Interpretive Center. In October of last year, the Interpretive Center recorded our 100,000th visitor. LM is currently working with the State of Mississippi to transfer the 1,476 acre Salmon Site to the Mississippi Forest Commission as wildlife refuge and forest demonstration project.

Once cleanup actions are completed, LM will work with EM to support the transfer of the 306 acre Mound Site to the Miamisburg Mound Community Improvement Corporation (MMCIC) for community reuse. MMCIC has been working with DOE since 1993 to develop the property as a light industrial park and to date the Department has transferred 179 acres to MMCIC.

Finally, LM has worked closely with GSA to dispose of three properties in the last two years the Wayne Interim Storage Site the New Brunswick Laboratory in New Jersey, and a portion of the Canonsburg Disposal Site in Pennsylvania. LM is currently working with GSA to provide two additional sites, located in Monticello, Utah and Grand Junction, Colorado for community reuse.

CONCLUSION

In closing, the Secretary is committed to ensuring that the Department meets our post-closure responsibilities. These include the protection of human health and the environment, access to records and information, meeting our commitment to former contractor workers, and maximizing the beneficial reuse of properties no longer needed for Departmental missions.

Mr. PASTOR. Assistant Secretary, first of all, I want to commend you for your safety first orientation. Because I think sometimes we forget the mission is protecting not only the public, but our own employees and our own contractors. So they get to have a good quality of life and get to go home safe and healthy. So I commend you for that.

There has probably been—and you mentioned it yourself—a goal to get at cost on time. I know that the agency has had an unwanted reputation of having many cost overruns and schedule delays. I know that that has been a concern with some of the subcommittee members, as well as the public.

And on page two of your testimony, you talk about the new initiative that you are going forward with, the business model approach. Could you go into a little bit of detail, how this model differs from what you have done in the past, so we can get a sense of how we are going to deal with the cost overruns and schedule delays?

I guess I would like for you to answer that.

Ms. TRIAY. Absolutely. I would be glad to, Mr. Chairman. Thank you.

The one initiative that I mentioned in my testimony dealt with adopting the practice of the Office of Science of performing construction project reviews in order to identify issues and deal with them before we then have to react to the problems.

I can assure you that the construction project reviews that have already been conducted in the Environmental Management Office are very thorough reviews in all aspects of the work, the technical aspects of the work, the management structure of the projects, dealing with specific recommendations that allow us to proactively deal with the risks associated with the projects.

Mr. PASTOR. Let me interrupt for a minute; in your testimony, you say that, in fiscal year 2009, that you reviewed five major construction projects. What were they? And how did you come up with the ratings?

Ms. TRIAY. We reviewed the Waste Treatment Plant, Sodium Bearing Waste Facility in Idaho, the Depleted Uranium Hexafluoride conversion facilities in Portsmouth and Paducah. We also reviewed the Salt Waste Processing Facility at the Savannah River site, and the Uranium 233 Down Blending and Disposition Project in Oak Ridge.

With respect to how they come out for the sodium bearing waste facility in Idaho, it is a matter of contractor performance for construction, so that we can keep the contingency that we have assigned to the project, and carry it into the start-up of the facility.

We think that the project is going well. It is challenging, no doubt, but the project is going well, and that is what the construction project review delineates.

Mr. PASTOR. You describe this as going well, but is it on time, on schedule?

Ms. TRIAY. Remember that——

Mr. PASTOR. Under budget?

Ms. TRIAY. The sodium bearing waste project was baselined about a year or so ago. Partly because we wanted to keep some of the decontamination and decommission in parts of the clean-up stabilized and partly because of issues with the design and the construction of the project.

With a new baseline that has been put in place that essentially coincides with the focus of the Department to say we are going to get off of the GAO high-risk list, we are going to be coming in on time and on cost on that revised baseline for cost, schedule and work scope.

Mr. PASTOR. For the sodium facility?

Ms. TRIAY. For the Sodium Bearing Waste Facility. The project that deals with the Depleted Uranium Hexafluoride Conversion Facility plant, we are running ahead of the revised baseline that was put in place, as well as under cost.

Again, this is compared to the revised baseline for cost scope and schedule that was put in place as a result of our efforts to try to make sure that we had good cost estimating and that we were not just being optimistic with respect to how much the projects were going to cost.

So with the current baseline, we think that we can deliver the operation at both the Depleted Uranium Hexafluoride Conversion Projects without further cost increases or schedule delays.

The Salt Waste Processing Facility also has a revised baseline that has substantial amounts of contingency. And the construction project review also found that we could deliver the cost and schedule of that baseline.

What we do need to do in the Salt Waste Processing Facility is align the project and the contract. You know, we are in the process of dealing with requests for equitable adjustment from the contractor, and our priority there is that alignment, because it allows for more effective project management.

With respect to the Uranium 233, the decision that I have made, in concurrence with my line management in the Department of Energy, is to not repeat the mistakes of the past and stop designing and constructing at the same time. The design build approach that we have used for major facilities such as the Waste Treatment Plant.

So what we have done is utilize all the resources that we have to complete the design first. And that was in concert with the construction project review's finding.

So that is what we are doing in that project. We are not going to establish a revised baseline for cost, scope and schedule until we finish the design. And we are not going to start construction until we complete the design.

We realize that the Uranium 233 is a high risk for the Oak Ridge facility. But we believe that we will lose more if we start trying to accelerate by using the design build approach that we have used in this project, as well as other projects. However, at the end of the day that cost more money and it takes longer.

Part of the discipline and the recommendations that the Government Accountability Office has provided deal with the completion of the design before construction begins, and that is what we intend to do in this particular project.

For the Waste Treatment Plant, that is a highly complex project. What came out of the construction project review is that we needed to, number one, close on all of the remaining technical issues. That then allows for the acceleration of design.

As I testified, the increased $50 million over the flat funding that we normally request for the Waste Treatment Plant is specifically to accelerate the completion of the design so that when the project is started in this designed build approach, we minimize the risk to the project.

In addition the construction review team discussed areas like management structure and other things that could be improved in the project. We have followed the lion's share of those recommendations.

I believe that there are two things that absolutely need to happen in the Waste Treatment Plant. We are poised to address all of the technical issues that remain, and in addition accelerate the completion of the design.

Without that completion of design, the project continues to be at risk as we move forward. Right now, it is our commitment to finish the project for the current cost of $412 million and by 2019. We have made that commitment to the state of Washington, as well as the Congress.

Mr. PASTOR. Thank you.

Rodney.

Mr. FRELINGHUYSEN. On page three of your testimony, you list Environmental Management's clean-up priorities, and you state that they have not changed and you remain committed to. And then it goes over activities to maintain safe, secure compliance operations, a radioactive tank waste stabilization, which you have referred to, special nuclear materials, storage, high-priority groundwater remediation, high-priority TRU waste, soil and groundwater remediation, excess facilities, and decontamination.

My question sort of gets to the whole issue of how you prioritize. In other words, you are doing all these things. I am sure you are doing them well. You enter into agreements with a lot of states. I would assume, and in some cases I know, there are federal courts that are involved in some of these situations.

How do you actually prioritize, whatever you call consent decrees or memorandums of understanding? I am sure there is a DOE terminology.

How do you do it and not become straitjacketed by what your predecessors have done?

Ms. TRIAY. When we enter into agreements, we make every attempt to keep these priorities in mind. It so happens that every state has the same priorities overall.

In other words, if you were to go to the state of Washington and ask whether the priorities are appropriate within that state or the state of Idaho within that state, what are the priorities within that clean-up, I think that overall, the priorities are going to be the same as has been delineated here.

Mr. FRELINGHUYSEN. Yes, the priorities are going to be the same. I have been to Hanford. It has been a while. And I think some remarkable things have happened up there. But obviously, some of these sites you could use a lot more money, maybe. You are going to tell us maybe how the stimulus money has been spent.

I just wonder to what extent—despite your well-known reputation for no-nonsense and leadership—how you prioritize.

Ms. TRIAY. The commitment that I have made to the regulators and the states is that we are going to have complete transparency with what we call the life cycle costs of the program.

So we have a life cycle cost that goes through the balance of the clean up, for every single clean-up that we are involved in for the legacy portfolio of the Environmental Management program.

So the first step is to have the discussion so that they understand the budget associated with the different parts of the clean-up. And then the second step——

Mr. FRELINGHUYSEN. "They" being?

Ms. TRIAY. The state, the regulators, the stakeholders, and our colleagues in the environmental activist communities. They all have tremendous interest in understanding what we call the baseline, cost, schedule, work scope.

Mr. FRELINGHUYSEN. So they have interest and anticipation, right, and expectations?

Ms. TRIAY. Yes, and the reason for it is that—if you are a regulator, you are not going to acknowledge that because of lack of funding, it is okay to miss a milestone. Of course not.

But on the other hand, in establishing milestones, the milestones that get chosen to have penalties against them, as an example——

Mr. FRELINGHUYSEN. So, just so I understand——

Ms. TRIAY [continuing]. Could very well be priorities. Yes.

Mr. FRELINGHUYSEN [continuing]. The milestones where there is a penalty associated with it? I assume all your programs have milestones, goals and objectives. But if there is some penalty involved, that obviously—this is the issue of priorities.

Ms. TRIAY. Right. And that is why I think that dialogue with the states and the regulators, as well as our colleagues in the environmental activist community that have a lot of interest in the clean-up, is essential. It is those conversations that then allow us to fine-tune these high-level priorities. The items that you have delineated here from my testimony are high-level priorities.

Mr. FRELINGHUYSEN. Respectfully, when there is a potential fine involved—does that raise the ante, in terms of your responsibility to address the issue?

Ms. TRIAY. I would like to think that it is almost the other way around. When we are establishing milestones together with regulators, it is a collaborative process. They propose, we propose, and an agreement is made.

We would both like for those milestones that have penalties associated with them to be the highest priorities from health, safety and protection of the environment. So with——

Mr. FRELINGHUYSEN. And are they?

Ms. TRIAY. Yes. With a good dialogue with the regulators, the communities, the states, and the colleagues in the environmental activist communities, that is possible.

Mr. FRELINGHUYSEN. You have got everybody. You got Washington State. You got Savannah. You have got, obviously, Oak Ridge. You have got Idaho. I mean, I would never forget Idaho.

Ms. TRIAY. I believe that if you actually look at the clean-up agreement, the one that everybody has heard about, the tri-party agreement at Washington State, or perhaps the Idaho Settlement Agreement. Those are agreements that go to the core of the cleanup. The tri-party agreement, the consent decree that we have been discussing, the consent decrees about tank waste.

Mr. FRELINGHUYSEN. So do all of those agreements which have milestones—in some cases, financial penalties that the taxpayers would pick up—how do they jibe with your list of eight here? In other words, some of these obviously do not have equal value with others.

Ms. TRIAY. As I was saying, these are high-level——

Mr. FRELINGHUYSEN. This is not a trick question. I would just sort of like to know. You have eight priorities and——

Ms. TRIAY. We established priorities at a high level, which then establishes the funding outlay against the total $6 billion. But within the site, say that a site gets on the order of $450 million per year or $500 million per year. For that general outlay of the funding, there is a negotiation for prioritizing the actual work, the actual milestones that are going to have penalties——

Mr. FRELINGHUYSEN. And on that site there are obviously milestones and priorities. I am not just wondering about the overall——

Ms. TRIAY. The overall framework defines the funding outlay that we have delineated for the particular sites. For the past 5 years, the funding for the sites has not dramatically changed.

Mr. FRELINGHUYSEN. And is it mirrored in your spending of the stimulus money?

Ms. TRIAY. In the stimulus funding, it is——

Mr. FRELINGHUYSEN. I think I know the answer.

Ms. TRIAY. But the reason for that is, the stimulus funding objective was of course to make progress, but also to create jobs. So we chose specifically for the Recovery Act portfolio types of work where there were proven technologies, where the regulatory framework had been established, where we had a demonstrated track record of performance, where we could actually hire individuals and train them in the nuclear field and be able to have them work to make progress in an expeditious manner.

Therefore, we selected on purpose transuranic waste, loadable waste, soil and groundwater remediation, and decontamination and decommissioning for the Recovery Act portfolio.

And the base program goes to the highest priorities based on per unit volume, tank waste, spent nuclear fuel, and excess nuclear materials. It is almost the reverse. But it is because the Recovery Act has two objectives: making progress, but also creating jobs. And in order to create those jobs, we specifically showed projects that have a proven track record of excellent performance.

Mr. FRELINGHUYSEN. Okay, thank you, Madam Secretary.

Thank you, Mr. Chairman.

Mr. PASTOR. In order to accommodate you and also going back and forth, I will start with Simpson, Berry, Rehberg, Davis, and Alexander. We will go in that order.

So, Simpson.

Mr. SIMPSON. Thank you, Mr. Chairman. I have to leave at 3 o'clock to start a National Park hearing down at Interior.

So thank you for being here today. And let me also publicly thank you for the work you did with OMB in making sure that the

E.M. clean-up budget accommodated the needs all around the complex. I know that that was kind of a fight with OMB, as it always is, to try to make sure that those resources are there.

The advanced mixed waste treatment plant in Idaho has had nine extensions of their contract. That creates an unsettling—you know, it is like monthly extensions. It creates an unsettling position for the employees, for the contractor, other things.

What is holding up the contract? And when can we expect that decision to be made?

Ms. TRIAY. We have published on our Web site acquisitions for which we are going to make the award between January and March, and for which we are going to make the award by the end of this month. So we are well on our way to making the award by the end of March.

Mr. SIMPSON. Okay, I appreciate that. Let me talk about another subject for a minute, the implications of Yucca Mountain on the E.M. budget. I do not want to get in the pros and cons of the decision on Yucca Mountain or anything, but what does it mean for the vitrified high-level waste at Hanford and Savannah River? What does it mean for the high-level waste that is currently stored in Idaho, the defense waste, and other things?

Since the termination of Yucca Mountain, have you consulted with the major stakeholders about the implications for their inventories of spent nuclear weapons? How will this impact the current agreements that you mentioned, the tri-party agreement, the Idaho governors agreement, and so forth? Will we meet the milestones on there or are we looking at penalties down the road? Or do we not know yet?

Ms. TRIAY. We are committed to meeting the requirements of those agreements. As the Secretary has said, he is relying on the Blue Ribbon Commission to come up with a robust path forward for high-level waste and used nuclear fuel. So we are committed to those agreements.

I would like to just point out that a decision with respect to a federal geologic repository is really not on the critical path for any of the clean-ups that you mentioned, not at Savannah River Site, not at the Washington State, and not in Idaho.

The Energy Community Alliance approached me about having a thorough workshop with the stakeholders, to make sure that we are completely understanding of the issues that they have and that we can answer the questions that they have.

As you know, in Idaho, we are very close to being able to finish all of the tank waste work. And, the final disposal is not on the critical path to putting that waste in a very stable and protective waste form. The same thing goes for Savannah River and Washington State.

Mr. SIMPSON. Of course, Washington and South Carolina are currently filing a lawsuit against the Department of Energy.

Ms. TRIAY. But to be fair——

Mr. SIMPSON. I do not know whether they have a case——

Ms. TRIAY. On the path forward that we have for the clean-up, the ultimate decision of where the waste is going to be disposed of is not on the critical path of that clean-up fast forward.

And both Washington State and the Savannah River site, the regulators, the state, the community leaders have worked closely, with the Department of Energy on the path forward for the clean-up that ultimately puts the radioactive waste into stable waste forms.

Mr. SIMPSON. Yes. Well, I would encourage the department to work with the various states. The state of Idaho has not joined the lawsuit as of yet. I am trying to encourage them not to, quite frankly. I do not know that there is actually a suit that they have out there. Because the DOE really has not violated anything until 2035, when they are supposed to have the waste out of there. And we have not seen what the path forward is yet from the Blue Ribbon Commission and so forth.

So I would encourage you to start working—or at least be out and talking to the states, the DOE, about what is going on and what the implications are for the various clean-up sites and so forth.

A question for you, Mr. Geiser. I understand that this committee with the ARRA funds, we hired a number of employees to accelerate clean-up at Idaho and stuff. They are now looking at plans to lay off those employees, once the clean-up is done. It is going to be—you are going to lay those off once the ARRA funds have been spent and so forth.

I understand that this committee provided, many years ago, $5 million for worker transition at the INL at that time and that there is still $1.5 million in remaining funds. Will those funds be used to help those workers that transition out of employment, you know?

Mr. GEISER. Sir. Sorry, prior to fiscal year 2005, there was $1.5 million set aside, I think, in a supplemental bill to provide for workforce retraining for employees at the Idaho National Laboratory. And of that $1.5 million, I believe there is approximately $1 million left.

That money is available or historically has been available for activities like tuition reimbursement, worker retraining, resume writing, placement services. So that money is available with Idaho.

And I did have a discussion with the Idaho Falls mayor and a representative from the eastern Idaho Chamber of Commerce a week ago or so. They were going to pursue that with the Idaho Operations Office. I am not sure where that discussion is, but their proposal seemed viable at the time.

Mr. SIMPSON. Okay. Because there will be some layoffs that come from that. I mean, you know, there was an acceleration of employment and clean-up, and there will be some layoffs.

One last question. Your pensions issue—for example, your budget says that the projected pensions liability for environmental management will drop from $567 million to $153 million. Could you tell me about the pensions issue, how you are going to address that across the complex, either one of you?

Mr. GEISER. I can speak to Legacy Management pensions.

Mr. SIMPSON. Okay.

Mr. GEISER. At this point, the contractor pension plans that we are responsible for funding are at the 90 percent funding level or higher; so we actually were able to reduce our request for fiscal year 2011 for pension payments. Largely, that is attributed to the fact that when the sites close, the workers are in what we would call a closed population pension plan.

The timing was fortunate that we received the major sites from Environmental Management in 2007. And so the contractor went from a very aggressive stock-based pension plan portfolio in 2007 to a very conservative bond approach. And we actually made money over the last 2 years, so our pension——

Mr. SIMPSON. You are the only ones.

Mr. GEISER. All right, so it was not necessarily brilliant financial management. It just happened to be good timing. So we were fortunate in that we had this closed population and that the contractor went to a more conservative investment portfolio. So we still have a request in the fiscal year 2011 budget to meet the ERISA minimum payment, but it is down from fiscal year 2010.

Mr. SIMPSON. Okay. Well, let me just say, I need to move on, but I appreciate the work that you are doing in Idaho. You are doing a great job cleaning the place up. And we appreciate it very much. I know that some people have said, "Boy, Idaho really took it in the shorts in the president's request," if you compare last year's budget to this year's budget. But you have got to realize that in there is the completion of the sodium bearing waste facility. So you would expect, once that is completed, that that budget would go down.

So I appreciate the work you have done on that, and look forward to working with you to make sure that we meet our obligations.

Ms. TRIAY. Thank you.

Mr. PASTOR. Well, that is a point of confidence, that the congressman is happy with the president's request for Idaho. Yes, but I think it is on the record, so we are going to frame that and send it to——

Mr. SIMPSON. It is a lot better——

Mr. PASTOR. Well, in response to Mike, I have members from Washington state, as well as South Carolina, who are very concerned about the Blue Ribbon Commission continuing to look at the deep geological deposit.

But I heard you to say—and I just want to make sure I am correct—that the clean-up at these sites—and you named three of them—can continue—it is not on a critical pathway.

Ms. TRIAY. Mr. Chairman, you are absolutely correct. That is what I said.

The decision as to what is the ultimate disposal of the high-level waste or the used nuclear fuel at the three sites that I mentioned—Washington, Savannah River Site, Idaho—is not on the critical path. In other words—we are moving forward with the clean-up that we have delineated.

That is why you see that, if anything, the president's budget increases some of those areas, like the Waste Treatment Plant that we were just discussing. I believe that we have come up with a path forward in collaboration with the states, in terms of the protective waste forms that are going to be produced as a result of all of these capabilities that we are building.

Three of the construction projects that you and I discussed at the beginning of the hearing are for dealing with tank waste, the Salt

Waste Processing Facility, the Waste Treatment Plant, and the Sodium Bearing Waste Facility in Idaho.

You are absolutely correct that progress on the clean-up, in other words, the removal of the waste from the underground tanks, followed by the processing of that waste, followed by the treatment of that waste, followed by the generation of very protective waste forms for human health and the environment, such as glass, does not necessitate the final decision regarding the geologic repository.

Mr. PASTOR. Marion.

Mr. BERRY. Thank you, Mr. Chairman.

I have not been on this committee all that long, and everybody on the committee knows I am not a nuclear physicist. Did I understand you to just told Mr. Simpson from Idaho that you all had finished something? [Laughter.]

Ms. TRIAY. At Idaho, sir, we actually have had a tremendous amount of success stories. For instance, transuranic waste. The agreement that Congressman Simpson was talking about that requires a particular amount of waste be in this position and the Waste Isolation Pilot Plant in New Mexico from Idaho; we are ahead of all of the environmental compliance milestones in that agreement.

The transuranic waste disposal at Idaho is done as a matter of routine at the Idaho operation. In addition to that, in 2010, we are going to finish moving all of the wet used nuclear fuel to dry at the Idaho facility.

In addition to that, we are going to finish the Sodium Bearing Waste Facility. We are going to treat that waste, and we are going to meet the environmental compliance commitments that we have to produce a protective waste form from those that highly radioactive underground tanks.

The Idaho operation routinely performs above expectations. We have something that is called a cost performance index and a scheduled performance index.

Today, we have the decontamination and demolition activities at Idaho, that for every dollar spent, you get $2.60 worth of work. And I believe that Congressman Simpson agrees, that the performance of the Idaho clean-up contractors and the federal staff has been exceptional.

Mr. BERRY. If I had known you were going to say all those nice things about Idaho, I probably would not have asked the question. [Laughter.]

You got the Chamber of Commerce. In these three sites where you have tank waste, you use three different techniques. Is there a particular reason for that? Or would it not save any more to use the same technique every place?

Ms. TRIAY. The reason for the different approach at Idaho, versus Savannah River and Hanford, which are very similar approaches, is that Idaho started the work that led to this highly radioactive waste in underground tanks later than Hanford and Savannah River sites.

So Idaho was wise in how they laid out how they were going to produce this waste. They produced this waste in an acidic form rather than in a form that, like the Hanford and Savannah River sites, where you have a lot of precipitates, or a lot of solids associated with the waste.

So if you actually look at the tanks after clean-up at Idaho, you can see the bottom of those tanks, and the clean-up is done in an extremely effective manner. Even the material that the tanks were built with, is a material that actually allows us to perform these extremely robust clean-ups.

So the reason that Idaho is different from Savannah River and Washington state—is because in the nuclear weapons production, they came to do similar work much later into the cycle, and we were smarter with respect to environmental protection.

In Washington, and Savannah River, we have very similar approaches. We have a vitrification plant to produce glass logs that have a fraction of the highly radioactive waste from in the underground tanks.

We have a low-activity waste path forward, where the low-activity waste is going to stay in the state of South Carolina or in the state of Washington. And we have a treatment step that separates the bulk of the volume with a very small amount of radioactivity, from a smaller portion of the volume with a vast majority of the radioactivity, over 99 percent.

The reason the treatment step is somewhat different between the two sites is because in South Carolina, at the Savannah River site, they used one process predominantly, which is the PUREX process. At Hanford, they were doing research and trying to do different testing, different processes, and therefore, they have a lot more chemicals in that tank waste.

Savannah River has twice the amount of radioactivity than the Hanford tanks, but the Hanford tanks have thousands of more chemicals than the Savannah River.

Mr. BERRY. Thank you very much. That is the first time I had ever heard anybody in this committee mention finishing something, and I am glad to know that it does happen.

Mr. PASTOR. Rehberg.

Mr. REHBERG. Thank you, Multihazard Mitigation Council. As you can imagine, I do not get a lot of questions about this budget in Montana as I travel around, but I do get a lot of questions about the stimulus bill and the money that was spent.

And as I understand in looking at some of the numbers that you initially alluded to in your opening statement about jobs saved and jobs created, you have 18 sites that are currently being cleaned up. No new sites were added as a result of the stimulus. So it was a continuation or an expansion of existing clean-up.

Could you explain to me then, as I understand—and I defend parts of the stimulus, even though I voted against it. You build a highway; economic development can be created. It is an asset. You rebuild a bridge; it is an asset.

Just exactly what is the asset of the sites that you are cleaning up that ultimately would make permanent jobs as a result of a temporary expenditure?

Ms. TRIAY. I thank you for that question and for the opportunity to address that. The Environmental Management clean-up is one of the biggest liabilities of the federal government. So our intent in the selection of the activities that we have in the portfolio is what we call site footprint reduction.

What that means is, get rid of the waste, disposition of the waste, deal with the contaminated soil and groundwater, demolish and clean up excess facilities in the complex.

All of that leads then to being able to free up vast tracts of land with two geochemical characterizations. Where the resources surrounding those sites in the complex are composed of very technically sophisticated communities that could help in the energy future.

Mr. REHBERG. Are you able then to define the difference between private opportunities, privately held properties deeded, as opposed to federal properties? Or are you mostly talking about cleaning up on federal properties, that then the federal government can, cannot or will not sell, or trade?

Ms. TRIAY. The federal government routinely—for instance, at Oak Ridge, transfers land from our portfolio into the portfolio of the community that has——

Mr. REHBERG. Government to government?

Ms. TRIAY [continuing]. So that they can——

Mr. REHBERG. Can you name any situation where it was transferred to government and sold on the free market for economic expansion or development?

Ms. TRIAY. I cannot give you an example of that.

Mr. GEISER. I can give some.

Ms. TRIAY. Go ahead.

Mr. GEISER. Just, sir, last fall, we actually dispositioned—that is the term we use—a four-and-a-half acre site in New Brunswick, New Jersey, to a private entity. That was a site that had been cleaned up under the FUSRAP program.

Mr. REHBERG. You sold it?

Mr. GEISER. We sold it through the General Services Administration.

Mr. REHBERG. I am looking at the numbers, you have filed a claim on your Web site: jobs saved or created, and it seems to be the total of 7,718. If you do not come in for exactly the same amount of funding, those are all temporary jobs, correct?

Ms. TRIAY. Yes, those individuals, they have been hired for the entire Recovery Act period. We have an internal goal through the end of 2011, because we wanted to accelerate and maximize the job creation.

Mr. REHBERG. Okay.

Ms. TRIAY. I just wanted to make sure that I tell you that many of the communities surrounding our sites are very interested in coming up with a vision that allows them to use these vast tracts of land for a beneficial reuse. And that is something that has already been a very good, proven concept for Legacy Management. The Mound site, and many other sites, that we have been able to transfer.

We are looking at different models, the model that you asked about, and also leasing land, for specific private ventures to come into those cleaned-up footprint areas in our different facilities, and as well of transfer of land——

Mr. REHBERG. Just one more question, Mr. Chairman—were you responsible for the clean-up down in Denver where the new airport site is? If you remember, that was strictly military?

Ms. TRIAY. I think the Department of Defense, yes.

Mr. REHBERG. Okay, because that seems to be a success story in my mind of economic development was built upon, or that replaced a dirty site that was cleaned up. If you have got other examples, I would sure like to have them.

The construction is about the only thing I can defend in the bill as something that was somewhat stimulative. It is not that I am against things like food stamps and Head Start. I am certainly for them, but it would seem like those would have been traditional appropriations requests and through the normal appropriations process, as opposed to rolling them into a stimulus package. But today's not the day to argue that.

But I can see where, in your expenditures—an asset is created by the cleaning up. All you have really done is speed up the amount of time. And I appreciate you doing that. It is going to have to eventually be cleaned up anyhow. I am just sorry it was using borrowed money.

Mr. PASTOR. Mr. Geiser, I think you were going to respond also to the congressman about—I saw where somebody came to give you some information. I do not know if you want to share it or we will go to the next member.

Mr. GEISER. Well, yes, that was not a member of my staff. It was something that the department did about 15 years ago that I remember happening, but I do not have any details on it.

Mr. PASTOR. Okay.

Ms. TRIAY. But if I may—I would like to take this question for the record and give you the information on the land transfers. We have a private industry that has come in to establish businesses on the lands that we freed up as a result of the clean-up. So we would like to give you a comprehensive list, if we could.

Mr. REHBERG. Thank you.

Mr. PASTOR. Davis.

Mr. DAVIS. Madam Secretary, thanks for being here today. I want to thank you for the ease of working with you and your office on issues that certainly are important to the area that I represent and others in Tennessee. You have been someone who has had an open ear and as suggestions are made, you are very willing to sit down and discuss issues that are important.

In an answer to my friend from Wyoming, USEC in Oak Ridge is on the old K–25 facility. It is a private-owned company. And as a result of the clean-up, this company now, they are in autocross in Ohio and other places, employ somewhere around 2,500 folks. They could not be in Oak Ridge today in the old facility of K–25 unless this clean-up had actually happened.

So it is more than just, has it been transferred to a private entity? Is a private entity working in those facilities, doing something that is great for America? I believe that the centrifuges process that we see there is something that is going to turn out to be great for this country. That facility is run by a private company, with private investors. As a result of the clean-up, they were able to locate there, as well as other sites that we have.

Second thing I want to point at, a lot of folks call it the stimulus package. It was the American Recovery and Reinvestment Act. They say it had nothing to do with long term down the road.

From the last quarter of 2008 and the first quarter of 2009, we lost over 4 million jobs. Had we not lost those, we would be at about 6.5 percent unemployment today. So when we talk about this, it is not a stimulus bill. It is investing in America and investing in America's future.

And as we invest those dollars, the 1,500 folks who will be working at the integrated facilities in Oak Ridge, for instance, up through a 2-year period of time, will have a good job. As I look at this list, we have only $90 some billion, and we say we may need as much as $250 billion to clean up the E.M. sites that we have actually designated?

The process at Y–12, should we have an accident there, would shut down the programs that we have today. The ongoing progress that we have. So it is more than just saying how we transferred this to some private entity.

If we have an accident in some of those integrated facilities all across our nation. Especially there where I have a partial representation of Oak Ridge—if that shuts down, it shuts down highly enriched uranium processing. It could shut down SNS. It could shut down our supercomputers. We could be denied for weeks, days, months or even years of going back, if we have an accident there.

So as we talk about—the quicker we get it cleaned up, whether or not it is economic recovery and reinvestment money or whether it is dollars that we appropriate from year to year, the better off we are. It is time we start investing in America's infrastructure instead of whatever we have been doing the last 30 years that has done nothing for us. Just look at the legacy buildings that we have had there and the cost of maintenance. In Oak Ridge alone, $200 million a year, just to ventilate those buildings, to go through them, run them out through a flume, and then recycle the air over and over again.

So what we have done with the American Recovery and Reinvestment Act has stimulated the economy. So you can call it a stimulus from that standpoint, because it is working currently.

I am pleased that at least you are in this position. Would you speak to many of us who have deep concerns about some of the legacy sites that we have, continuing to be a dangerous situation for America's defense, America's security, and America's future, if we do not clean these buildings up.

So as far as I am concerned, if you were to suggest that we had a $200 billion E.M. economic recovery or stimulus package, I am willing to support that. I just want to get it done so we can move on. We have invested in our infrastructure through the 1950s, 1960s, 1930s, 1940s, 1970s, and 1980s, and then we quit about somewhere along the early 1980s. We quit investing in infrastructure, and it has been deteriorating and falling down as a result of it. So what we have been doing, I support it.

In Oak Ridge, we have got 12,000 people; 400 work for the federal government; 11,600 work for a private contractor, an entrepreneur, in the free enterprise system. It just happens to be that taxpayer dollars are used to hire these folks to do work that we need.

But as we do the clean-up on the E.M.-designated areas, I hope that we continue to have an independent third party to actually verify what is going on there for several reasons. I think that if we have that, at least employees will feel safer. We will know that the sites are cleaned up. At least we will have third-party verification of that.

So it is my hope that you can continue to do that. And I am asking you if that is part of the plans.

Ms. TRIAY. It is. I mean, we have a clear policy in the Environmental Management program to use entities like Oak Ridge Institute for Science and Education, which I know that you are very familiar with, to come in and verify the clean-up.

So we are going to continue with that policy. We think that it is extremely useful to make sure that we have the credibility and the clean-up that we need to have.

I just wanted to make a comment on your previous comments on the Recovery Act. The Environmental Management program is estimating that we will award up to $2 billion to small businesses, contracts utilizing the Recovery Act funds, especially in Oak Ridge. We have had a tremendous amount of outreach, to get small businesses into this important area of nuclear work.

And you are absolutely correct that the environmental liability grows as the facilities that we need to deal with are still being maintained, rather than essentially completely cleaned up.

Mr. DAVIS. And the quicker we reduce that footprint in all of our national labs and in areas such as Y–12 and NNSA. The quicker we reduce that, the quicker we start saving.

As we talk about Y–12, for instance, I understand it is $200 million a year that it takes just to keep the buildings from freezing. So they continue to heat water and run steam through it. The steam leaks, you can hear the hot water leaking throughout the building, almost two or three stories up or down from where the leak is.

When they go in to start trying to repair it; it may break and shut down the whole operation in some place like Y–12, where our nuclear fleet depends on them. And the other work that we do, it is extremely imperative.

So the more we can do to reduce that footprint of the legacy buildings that are there, the buildings that helped save the world in the early 1940s, the better. At that time, we had never built this type of facility before, so we were not totally aware of what might ultimately happen.

We know today. And we have a responsibility not to just those communities, but to America and to the world. We know that we have to clean this up and get it done.

So as we talk about spending borrowed money, borrowed money; we spent $10 trillion since 1981 on no infrastructure in this country. As we hear some debate now about spending borrowed money, these folks must be backsliders. You know, we get religion, then we backslide when we get out of the church house.

So I wonder where these folks were, on the front row and in the front pew, when we added $10 trillion in debt that last 28 years. But thank you for being here.

Mr. PASTOR. Since we are about 6 months into fiscal year 2010, in your testimony, page two, you mention that you will do 10 reviews. I am just curious where we are at on those 10 reviews, and what have we found. Have we met the scope and schedule? Have there been any early warnings?

Mr. PASTOR. What are the 10?

Ms. TRIAY. The same five construction project reviews get reviewed every 6 months, sometimes sooner, depending on the magnitude of the project. For instance, at the waste treatment plant, we had the first review in August. We had our second review in November.

We have also utilized this approach of thorough reviews with peers that come to the table to try to figure out exactly what we could improve. We have also used that approach for some of the clean-up projects, that we have. In addition, to the five construction projects that reoccur every 6 months.

And I would just like to give you some of the things that we have found. In going through the Uranium 233 project at Oak Ridge, one of the things that these reviews found, was for E.M. to make absolutely certain that we understood the amount of transuranic elements that were associated with the final disposal form.

And we did exactly that. As a result we have changed some of the design, because a lot of the waste that will be produced will be low-level waste. This is beneficial, because it can be dispositioned in a less expensive manner than if it were transuranic waste.

We have thoroughly reviewed the East Tennessee Technology Park clean-up Project. That is one of the decontamination and decommissioning projects where we have experienced cost growth as well as schedule delays. Normally, our decontamination and decommissioning projects actually perform ahead of schedule and under cost.

This particular one has an issue because some of the technician deposits that need to be cleaned out of our K–25 building in this complex have turned out to be more technologically challenging than we anticipated. We used that review to look through some of the options that we could utilize to address that issue.

In the area of tank waste, we clearly were able to identify the aspects of the tank waste clean-up that could result in reductions in life cycle costs and a shorter period of execution. In particular, we are able to treat the waste at tank or near tank, which accelerates the process. We can start treating waste ahead of the Waste Treatment Plant and ahead of the salt waste processing facility at Hanford and Savannah River, respectively.

Our reviews clearly delineated, that that is something that we could do to shorten the period of execution, as well as reduce the life cycle costs of the program.

We also, as a result of these reviews, have identified how well our treatment schemes are going to work. And that has allowed us to concentrate on whether or not we could come up with aspects of the treatment technology that could also reduce the life cycle costs and the period of execution.

Ultimately, the main objective of the tank waste clean-up is to be able to load more radioactivity into the final waste form. It reduces the period of execution and also reduces the amount of waste that we generate at the back end, so those reviews have been very helpful in focusing our technology development needs so that we can delineate a robust technology development program and present it to the Congress.

Mr. PASTOR. Any early warnings could you highlight that the reviews provided?

Ms. TRIAY. The best example that we have of that is probably the Uranium 233 Project. Had we gone on to design, the treatment of the Uranium 233 the way that we had intended it was going to produce transuranic waste.

In reality, it became evident that we were going to produce a lot of low-level waste, and that really allowed us to incorporate those thoughts into a design.

Mr. PASTOR. Rodney.

Mr. FRELINGHUYSEN. I just want to get a little clarity here. I know Congressman Simpson lifted up the edge of the tent on Yucca, and I just want to make sure I understand. We tend in the community, quite honestly to be, shall we say, Yucca-centric here. I think there is a sort of a uniform feeling we are somewhat disturbed that this option was taken off the table.

I understand you do incredible work and that whatever you do can be kept on site for the foreseeable future in using the various technologies that you and your good people and contractors bring to bear. But in the overall scheme of things, nuclear waste is going to continue to be reduced. It is not the type of waste that you deal with, but it does add a degree of complexity and adds to the tension of future decision-makers.

Could you comment a little bit on that?

Ms. TRIAY. Well, what we do in the Environmental Management program is emplace the already existing waste——

Mr. FRELINGHUYSEN. Yes.

Ms. TRIAY [continuing]. A highly radioactive waste in underground tanks into a more protective waste form for human health and the environment. So we in the Environmental Management program——

Mr. FRELINGHUYSEN. And, of course, you have a number of sites or a number of sites around the country. And that obviously means that we have to continue to do the things that protect not only workers, but protect the constituencies that surround these sites.

Ms. TRIAY. That is absolutely correct. And my point was that we already have the waste. In other words, we have the mission of the legacy clean-up. The waste has already been produced. And now the question is, what are we going to do to ensure that we clean up the legacy of the cold war?

And for that reason, our chartering of the Environmental Management program is to produce waste forms that would be robust enough for almost any option that gets considered.

Mr. FRELINGHUYSEN. Yes, the different waste forms you have described.

Ms. TRIAY. Glass?

Mr. FRELINGHUYSEN. Yes, expurgation, also.

Ms. TRIAY. Mineralized forms, ceramics. But the program right now for high-level waste is concentrating on borosilicate glass, which is an extremely protective glass that is the standard of the rest of the world.

Mr. FRELINGHUYSEN. Could you comment on what is classified as unassigned clean-up legacy? I think this committee urged the department to assign disposition responsibilities for remaining spent fuel, special nuclear fuel. What is the status of that effort? That was a transfer of liabilities from the nuclear side to the environmental side.

Ms. TRIAY. Right.

Mr. FRELINGHUYSEN. And is that across the complex?

Ms. TRIAY. Across the complex in 2008, we had a data call so that all of the sites in the Department of Energy that had excess facilities and excess materials, waste that needed to be dispositioned, would come forward and provide us with that information.

From that, we wrote a report to Congress, and essentially we said that, based on level funding, the Environmental Management program could not tackle that challenge until about the year of 2017.

The Recovery Act changed that. We have been able, as a result of the Recovery Act, to start tackling many of those excess facilities that were declared by the different programs, NNSA, the science program, and the nuclear energy program, early due to the Recovery Act funds.

We have done that at Oak Ridge. We have done that at Idaho. We have done that at some of the science sites—like the Oak Ridge National Laboratory, as well as some of the NNSA facilities, such as Y–12.

Mr. FRELINGHUYSEN. So what remains to be done? You got a start under stimulus funds.

Ms. TRIAY. The portfolio of excess facilities that was not already in the legacy portfolio of the Environmental Management program is substantial. I believe that the Department reported to Congress that it was going to be total project costs on the order of $9 billion.

Mr. FRELINGHUYSEN. Monumental.

Ms. TRIAY. Yes. So the Recovery Act has been able to address some of those issues. But at the level funding we receive as we move forward, we do not have the flexibility to continue with those excess facilities that are not already in the legacy portfolio of the Environmental Management program.

That is our general policy. If a particular site has one of those excess facilities, it creates a hazard for that site, for the ongoing mission. We are always willing to reprioritize. We review the decontamination and decommissioning portfolio to see whether we can actually tackle the highest risks for that site.

Mr. FRELINGHUYSEN. In your testimony, you made reference—and maybe you want to enhance or add to that discussion—to your headquarter's reorganization. The whole environmental operation has been sort of reorganized, has not it? The sites now report directly to you?

Ms. TRIAY. That is correct. We were trying to streamline the reporting chain between the sites and headquarters in order to align our vision, mission priorities. We feel that, as we move forward and we hold ourselves accountable for flawless performance, this program has come of age. It is time for us to be able to estimate the cost of a clean-up, estimate the time that it is going to take, and deliver on cost and schedule for all of the activities that we are involved in.

Mr. FRELINGHUYSEN. So the reorganization has actually taken place?

Ms. TRIAY. The reorganization has taken place. The sites report directly to my principal deputy as the direct supervisor, with me as the second-level supervisor. In addition to that, we have instituted two officers, one for business and one for technical. We now have very clear roles and responsibilities where the senior leadership team of the Environmental Management program can speak with one voice, and try to make absolutely certain that we stay focused on the performance of the Environmental Management program.

Mr. FRELINGHUYSEN. So the specific problems that led to this reorganization have been addressed. One of those problems—the whole issue of cultural change and things of that nature has been changed in your operation here?

Ms. TRIAY. We believe that the oversight of the different sites and clean-up projects should be commensurate with their performance. The way that the model works is the headquarters oversees the field sites. The field sites oversee the performance of the contractor.

And the bottom line is that when there are performance issues, our role is not only to assist the sites in headquarters and for the site to assist the contractor, but also to hold accountability throughout the system.

The degree of oversight should be commensurate to how well the site is performing. The degree of oversight from the field to the contractor also needs to depend on the performance that the contractor is delivering. We cannot be satisfied with anything other than delivering quality product on time and on cost.

And when the weaknesses in performance are identified, we increase the degree of oversight from headquarters to the field or from the field to the contractor. There are always tensions——

Mr. FRELINGHUYSEN. Well, you have made some progress. Are there some areas where people have been basically out of compliance with whatever you set up as a new structure?

Ms. TRIAY. Clearly, we have had growing pains as we have tried to make sure that we implement this new business model that depends on strong oversight in order to make sure that we deliver a quality product on time and on cost.

Mr. FRELINGHUYSEN. Well, I know there are technical difficulties. I just wondered whether they are on the issue of what you call the missed milestones, are there—some that are——

Ms. TRIAY. We have an excellent record of environmental compliance in the Environmental Management program. Last year, we had 137 compliance milestones, and we met 95 percent of them. And in 2010, our goal is 100 percent compliance. And for 2011, it is 100 percent compliance, as well.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman.

Mr. PASTOR. Because you brought the issue up of cost estimating, GAO, in their 2010 report, basically said that DOE has not had a policy to establish the standards for cost estimating for over a decade. Its (DOE) guidance is outdated and incomplete, making it difficult for the department to oversee development of high-quality cost estimates by its contractors. They are not naming you specifically, but DOE in general.

And in the past, we have had to redefine baselines, as you well know, and we have. So my question is, what have you done to improve your cost estimates so that we just do not keep redefining the baseline? Because that just keeps pushing it forward, but it is over budget and not on time.

Ms. TRIAY. Absolutely. And that is not acceptable, Mr. Chairman. So the Office of Cost Analysis in the Department of Energy has the overall corporate responsibility for addressing the recommendations that were made by the Government Accountability Office (GAO) in the recent GAO report on the subject, just like you were mentioning.

And the deputy secretary response to these Government Accountability Office recommendations deal with the Office of Cost Analysis and the Office of Engineering and Construction Management issuing a cost-estimating policy and directive, standardizing the way in which we do independent cost estimates, and in making sure that those cost estimates are performed at critical decision points along the project.

DOE will centralize its cost-estimating functions and consider the organizational structure adopted by the Department of Defense. We in the Environmental Management Program have a Consolidated Business Center. In that Consolidated Business Center, we have team of cost estimators, headed by one of the most respected cost estimators in the complex, Terry Brennan. We believe that we are well poised to implement the corporate policies that are being developed in this area.

The Office of Cost Analysis will have the responsibility to address the this time recommendations of the Government Accountability Office, and we will plan and coordinate the schedule for those independent cost estimates.

The Environmental Management program also has made great strides in coming up with a database of all of the costs associated with performance that we have delivered in projects like Rocky Flats, Fernald, and other projects that we actually cleaned up ahead of schedule and under cost.

So I believe that in your question, what you focus on is something that we in the department are very committed to turning around. We agree that the old programs should be able to estimate the cost, estimate the schedule of a project, and deliver within the estimates.

Mr. DAVIS. Very briefly, as I look at the estimated cost of Environmental Management and the third paragraph from your testimony today, it says we still have between $193 billion and $247 billion to complete. Can you give me a projection of how many years that is going to take and what you will be recommending over the next 5 years, for instance, to help expedite this clean-up?

Ms. TRIAY. Our clean-up completion goes through the tank farm clean-up of Washington state. In other words, to finish the program, we have to finish that clean-up. And right now, we are looking on the order of decades.

Mr. DAVIS. Decades?

Ms. TRIAY. 2040s, essentially, to 2050 for the completion of that clean-up. The Secretary of the Department of Energy feels strongly. That is why he has promoted and in the president's request, we have a request for technology development, for investments in the tank farm clean-up that can actually reduce the life cycle costs and that period of execution.

About 35 percent of the life cycle costs of the Environmental Management program is due to the tank waste clean-up. We feel that if we could invest in enhancing the strategies that we have in place to deal with tank waste clean-up, we could reduce the life cycle cost and reduce the period of execution.

So as we move forward, we are going to concentrate on doing research and development, or developing technologies with the purpose of reducing the life cycle costs and the period of execution of the program.

Mr. FRELINGHUYSEN. Would the gentleman yield?

Mr. DAVIS. Yes, I will yield.

Mr. FRELINGHUYSEN. What technologies do you see out there? It comes to mind pump and treat and this and that, but I just sort of wondered what you see out there that might be exciting?

Ms. TRIAY. Sure. Specifically, in the tank waste clean-up area, we will be investing in being able to use techniques such as ion exchange or solvent extraction at tank or near tank, in order to accelerate the clean-up of the waste ahead of the start of facilities like the Salt Waste Processing Facility or the Waste Treatment Plant.

In addition to that, we are going to be investing in making sure that we understand the characteristics, the performance of waste forms. In addition to borosilicate glass, waste forms that also are glass, but can withstand more waste. Waste with more chemicals, like the Hanford chemicals, being encapsulated in the final waste form. This reduces the life cycle costs and reduces the amount of waste that needs to be ultimately dispositioned.

We want to also look into next-generation melters that also will allow us to load more waste, more radioactivity into the final waste form. We want to look into ways in which we could demonstrate that technologies that produce minerals in mineralized waste forms at lower temperatures, are just as protective of human health and the environment as the standard borosilicate glass.

All of this research and all of these technologies are with the express purpose of dealing with the life cycle costs and the period of execution. With respect to the groundwater, we believe that mercury at Oak Ridge necessitates advanced technologies. Some of them not only for the mercury, but for other radionuclides, dealing with bioremediation, and with electrochemical treatments.

We think that the ability to predict where the contaminants are, so that we can stop them from entering the accessible environment, is of the essence. That is why we are also investing in an advanced simulation capability for the Environmental Management program that works exactly from the platform that we have used for defense programs and should be done in a very cost-effective manner.

Mr. DAVIS. Thanks. So as I listened to that explanation, are we waiting on technology to do some of the clean-up areas, like mercury in Oak Ridge, or technology to advance to the point to where we can adequately do that?

Ms. TRIAY. There are times—and mercury is one of those examples—where in addition to trying to prevent the mercury from further migrating, and in addition to dealing with the source of the mercury; we also need technologies to deal with the ultimate problem. The areas of contamination are spread throughout different environments. There are times in those situations where we absolutely need better technologies than the ones that we have.

Mr. DAVIS. Thanks. I yield back, Mr. Chairman.

Mr. PASTOR. Well, that concludes the hearing. But before I close it, the University of Miami is not only known for its chemistry department and students that it produces, the doctorates, but they are well known for baseball, basketball, and football.

And as I fill out the teams for March Madness, I have a problem, because coming from the west, the only question I have is to Mr. Geiser is, where does he have Cornell?

Mr. GEISER. Sir, Cornell is going to go all the way this year. [Laughter.]

That is what my pool says.

Ms. TRIAY. I doubt it.

Mr. PASTOR. That concludes the hearing. Thank you very much.

QUESTIONS FOR THE RECORD

ENERGY AND WATER DEVELOPMENT SUBCOMMITTEE
HOUSE COMMITTEE ON APPROPRIATIONS

DEPARTMENT OF ENERGY: OFFICE OF ENVIRONMENTAL MANAGEMENT AND LEGACY MANAGEMENT

BUDGET HEARING

MARCH 16, 2010

---

1. ENVIRONMENTAL MANAGEMENT PRIORITIZATION

Question: The Environmental Management program faces a unique set of pressures. The Department has entered into agreements with states governing the cleanup of your sites, and many of these agreements have enforceable milestones built in. If you don't achieve these milestones, the U.S. taxpayer is on the hook for paying fines to the states. At the same time, your program is nearly one-quarter of the entire DOE budget, and you face a responsibility to ensure that every dollar is well spent across your many sites. What are the priorities for your program, and how does your budget request reflect those priorities?

Assistant Secretary Triay: For budget formulation, the Office of Environmental Management (EM) program ranks cleanup activities with the greatest risk reduction benefit and overlays its regulatory compliance commitments and best business practices to maximize cleanup progress. EM's Fiscal Year (FY) 2011 budget request positions the program to meet its regulatory commitments, supports reducing the risk associated with our highest environmental risk activities (i.e., tank waste) and achieves footprint reduction across the complex.

EM's FY 2011 budget request would enable sites to reduce EM's operations footprint from 900 square miles to approximately 540 square miles, a 40 percent reduction, with the goal of achieving a 90 percent reduction by 2015.

In FY 2011, EM will also complete the legacy cleanup at Brookhaven National Laboratory and the Separations Process Research Unit in New York, and the General Electric Vallecitos Nuclear Center and Stanford Linear Accelerator Center in California

2. STATUS OF FOOTPRINT REDUCTION AND SAVINGS

Question: Your "Footprint Reduction" efforts aim to shrink the overall area requiring clean-up by completing Demolition and Decommissioning (D&D) as quickly as funds permit at sites. How would you assess your progress on footprint reduction?

Assistant Secretary Triay: The Office of Environmental Management (EM) is on track to reduce the legacy footprint from 900 to 540 square miles by the end of Fiscal Year (FY) 2011, or by about 40 percent, leading to the goal of a 90 percent reduction by 2015. The table below shows the status of EM progress on activities that drive footprint reduction.

Performance Measure	Recovery Act Goal (through 9/30/2011)	Target to Date (through 2/28/2010)	Actual to Date (through 2/28/2010)
LLW/MLLW Disposed - Legacy and NGW (m3)	72,687	11,683	10,945
CH TRU Waste Processed (m3)	6,422	1,549	1,767
TRU Waste Dispositioned from Inventory (m3)	8,398	720	817
Facility Square Footage Demolished	3,134,668	404,396	407,295
Facilities Completed	226	46	48
D&D Debris and Remediated Soil Disposed (Planning Estimate only) (m3)	1,212,903	333,595	226,732
TRU Small Quantity Site Completions	8	1	1

Question: What are the footprint reduction objectives by site?

Assistant Secretary Triay: The table below summarizes the footprint objectives at each site. In general, EM expects to shrink the active footprint by at least 40 percent by 2011 with a combination of the American Recovery and Reinvestment Act of 2009 (Recovery Act) funds, appropriated FY 2010 funding, and requested FY 2011 funding.

Site	Reduction by 2011	Percentage	Name of Area of Cleanup
Hanford (Richland)	586 sq. mi to 290 sq. mi.	49%	Hanford Reach National Monument Area
Savannah River	310 sq. mi to 103 sq. mi.	67%	D-Area, M-Area, P-Area and R-Area
Idaho	1.21 sq. mi. to 0.6 sq. mi.	50%	
Oak Ridge	~0.7 sq. mi. to ~0.42 sq. mi.	40%	Portions of ETTP and ORNL
Small Sites	~27 sq. mi. to ~26.5 sq. mi.	2%	SPRU, SLAC, Mound and Brookhaven

Question: Please provide a break-out of base and Recovery funding and how it has and will support meeting footprint reduction objectives.

Assistant Secretary Triay: Of the $6 billion in EM Recovery Act funding, approximately $5.4 billion has been allocated to activities directly related to footprint reduction (i.e., Transuranic (TRU) disposition, mixed low-level waste/low-level waste (MLLW/LLW) disposition, soil and water remediation, and decontamination and decommissioning (D&D)). Recovery Act field activities started in April 2009 and are expected to be nearly 100% completed by September 2011.

Base program funding for transuranic, MLLW and LLW disposition, soil and water remediation and D&D for FY 2009 through 2011 is approximately $2.5 billion in FY 2009 (appropriation), $2.3 billion in FY 2010 (appropriation), and $2.4 billion in FY 2011 (requested), for a total of $7.2 billion for the three fiscal years.

Question: This progress should result in reduced annual costs for monitoring, surveillance, safeguards and security, and other hotel costs at sites. Do you have an estimate of these life-cycle savings by site? If not, when will you have an estimate of savings?

Assistant Secretary Triay: As a result of Recovery Act funding, EM estimates savings of about $4 billion (column A in table below) by accelerating existing EM scope planned for completion primarily in the years beyond FY 2011.

In addition, with this Recovery Act funding, EM was able to accept "new scope" associated with excess facilities from other department programs for cleanup. At several sites such as Idaho National Laboratory, Oak Ridge National Laboratory, Y-12 Site, and Argonne National

Laboratory, excess facilities were transferred from another Departmental program for remediation or demolition. EM is using about $600 million (column B in table below) of Recovery Act funding to address this "new scope," not previously in the EM program. By eliminating this future liability five to ten years earlier, these Recovery Act projects are estimated to save the Department $500 million.

EM also estimates cost avoidances of more than $3 billion (column C in table below). For example Recovery Act funding at Idaho, Oak Ridge, Savannah River Site, and Hanford has enabled these transuranic waste generator sites to accelerate shipments to the Waste Isolation Pilot Plant (WIPP) by many years, avoiding a schedule extension and higher operating levels, resulting in an estimated cost avoidance of $2.5 billion at WIPP, compared to what the cost would have been had Recovery Act funding not been received. The table below shows, by site, the (A) estimated savings, (B) new scope, and (C) cost avoidances. The estimates in each column are independent of the other two columns for each site.

Site	Recovery Act Savings (A)	Recovery Act New Scope (B)	Recovery Act Cost Avoidance (C)
	(in Millions)		
Argonne National Laboratory	0	85	-116
Hanford (Richland)	-2,033	0	0
Hanford (River Protection)	-82	0	0
Idaho National Laboratory	-432	218	-110
Los Alamos National Laboratory	0	0	-96
Moab	-72	0	0
Nevada Test Site	-40	0	0
Oak Ridge	0	271	-345
Paducah	-4	0	0
Portsmouth	-6	0	0
Savannah River Site	-1,150	0	0
Waste Isolation Pilot Plant	-120	0	-2,500
West Valley	-61	0	0
Other Sites	-5	24	0
EM Total	-4,005	597	-3,167

In addition, EM anticipates that several $100 million worth of additional cleanup scope could be accomplished if Recovery Act projects are completed below costs and ahead of schedule without consuming management reserve and contingency funds.

3. REGULATORY COMPLIANCE MILESTONES

Question: Does the fiscal year 2011 request support compliance with regulatory clean-up milestones across Environmental Management sites? If no, please provide the Committee a list of sites expected to be in noncompliance. Please describe whether the cause of the missed milestones is funding or due to other reasons, such as technical challenges.

Assistant Secretary Triay: The Office of Environmental Management's (EM) Fiscal Year 2011 budget request positions the program to meet its regulatory cleanup milestones. However in some instances, there may be technical issues that could impact achievement of a few milestones.

4. IMPLICATIONS OF YUCCA MOUNTAIN TERMINATION ON EM CLEAN-UP

Question: Have the uncertainties surrounding the permanent storage of nuclear spent fuel and high-level radioactive waste affected the Office of Environmental Management's programs in fiscal year 2011 and beyond?

Assistant Secretary Triay: The Administration's decision not to proceed with the Yucca Mountain repository does not affect the Office of Environmental Management's (EM) plans to retrieve, treat, and store high-level wastes stored in tanks or to treat and store spent nuclear fuel. EM is focused on addressing environmental and health risks by placing high-level waste and spent nuclear fuel in safe and stable configurations for long-term interim storage.

Question: What does it mean for the vitrified high-level waste at Hanford and Savannah River Site?

Assistant Secretary Triay: The vitrified high-level waste produced at Hanford and Savannah River Site will be stored on site, as is currently planned, until a final disposal path is identified.

Question: Does it affect the waste acceptance criteria that is used in the tank waste cleanup and treatment efforts around the complex?

Assistant Secretary Triay: EM will continue to produce the highly robust waste forms that have already been produced or are planned to be produced in its tank waste treatment facilities. The termination of the Yucca Mountain repository has no impact on the waste acceptance criteria.

Question: Since the termination of Yucca Mountain, have you consulted with the major stakeholders about the implications for their inventories of spent fuel and waste, as well as the impact on the agreements involving waste disposal and cleanup—e.g. Governors?

Assistant Secretary Triay: No, we have not consulted with the stakeholders; however, our stakeholders are aware that we intend to continue our tank waste projects as planned and in accordance with our compliance agreements as reflected in the Fiscal Year 2011 budget request.

5. ASSUMING ADDITIONAL CLEAN-UP LIABILITIES

Question: The Subcommittee is interested in the addition of clean-up liabilities from the Office of Nuclear Energy and the National Nuclear Security Administration, as well as other organizations. What criteria does the Office of Environmental Management (EM) use to determine suitability for incorporation into the EM scope of work?

Assistant Secretary Triay: EM has a comprehensive process in place to determine if cleanup liabilities including excess facilities and materials/wastes are suitable for transfer to EM from other Departmental Program Offices and the National Nuclear Security Administration (NNSA). DOE Order 430.1B, *Real Property Asset Management*, is the primary directive used to evaluate whether excess facilities satisfy EM acceptance criteria. In addition, EM adheres to the DOE Guide 430.1-5, *Transition Implementation Guide*, which contains guidance on the approach used to determine whether the excess facilities meet the criteria to be transferred to EM. Also, additional details and specifications regarding excess facilities and materials/wastes transfers into the EM program can be found in EM's *Standard Operating Policies and Procedures (SOPP) #34, Excess Facility Transfer to the Office of Environmental Management.*

More specifically, the criteria implemented by EM to determine the suitability for transfer of the excess facility into the EM program include: 1) the facility is "mission contaminated," defined as chemical or radioactive contamination resulting from mission operations, and not from construction activities and associated materials, such as, but not limited to, asbestos, lead-based paint and PCBs in light ballasts; 2) the facility must be certified as excess (surplus) to Departmental mission needs, not just the mission needs of the requiring Department Program Office or NNSA; 3) the facility must be a stand-alone building, and not a room, wing or annex of a larger operating complex; and 4) if a portion of an excess facility is proposed for transfer, a physical segregation of common systems (e.g. ventilation) and utilities and infrastructure shall be accomplished or funded by the Program Office or NNSA requesting the transfer.

Question: Does EM have an updated site-wide materials plan that describes specifically which materials are suitable for incorporation, which are not, and a time-line and funding stream required for clean-up? If so, please submit it for the record.

Assistant Secretary Triay. With respect to wastes and materials, the criteria for transfer to EM include: 1) materials/wastes have to be excess and not a strategic asset that must be retained; 2) be defined as TRU requiring disposition at the Waste Isolation Pilot Plant; or 3) require specialized treatment/processing and have no existing disposition path, thereby requiring EM expertise. Due to the exceptional considerations regarding special nuclear materials and spent nuclear fuel, the transfer of these are determined on a case-by-case basis. Once EM determines that the nominated materials/wastes are suitable for transfer from other Departmental Program Offices and NNSA, those materials/wastes will enter the EM program as completion of legacy work permits.

6. HEADQUARTERS REORGANIZATION

Question: The re-organization of the Office of Environmental Management changes the reporting lines in the organization. The sites now directly report to your office instead of through Deputy Assistant Secretaries. What specific problems is this reorganization aiming to solve? How will the reorganization help solve them?

Assistant Secretary Triay: By having the Office of Environmental Management (EM) Field Organizations report directly to the Office of the Assistant Secretary, I have clearly established direct authority and accountability for the execution of the EM program. This also recognizes and sharpens the focus of EM Headquarters. Program definition, priorities, policy, planning, budgeting and oversight are the province and responsibility of the headquarters organization. Program implementation is a Field responsibility.

Question: The reorganization will make the Office of the Assistant Secretary more accountable, but are you worried your executive office will become a bottleneck? What steps have you taken to ensure your executive office can handle the additional workload?

Assistant Secretary Triay: The reorganization is intended to make clear the roles and responsibilities of headquarters and field entities. Specifically, Field Managers are directly responsible and accountable to the Office of the Assistant Secretary for program implementation. If the Field Managers perform well and deliver their projects at cost and on schedule, they will be given more responsibility. However, if they have difficulty with project success, there will be greater involvement from Headquarters. For Field Managers, this provides a new mindset on the headquarters interface, but it also raises expectations on performance. This management approach will not be "one-size fits all." It will be based on how successful the Field Managers are in delivering projects on time and within cost.

In addition, the creation of a Chief Business Officer and Chief Technical Officer provides me with a fully integrated team of senior leaders to ensure that EM speaks and acts with one voice. Together, we will assure that the entire organization is led in a more cohesive and consistent manner.

Question: The reorganization potentially diminishes the role of the multiple Deputy Assistant Secretaries. Are all of the positions still necessary?

Assistant Secretary Triay: The reorganization does not diminish the role of the Deputy Assistant Secretaries. The establishment of the "Leadership Pyramid" serves to ensure the integration of EM senior leaders. EM senior leaders will still be responsible for the establishment and integration of EM wide policy, priorities and performance to ensure key technical and business functions. The Deputy Assistant Secretaries will continue to provide independent assessments and assurances that field operations are performed safely in conformance with the highest standards of project and acquisition management and have the resources necessary to perform their job.

7. SEISMIC DESIGN OF NUCLEAR FACILITIES

Question: The Defense Nuclear Facilities Safety Board (DNFSB), as well as the Department's own Inspector General, found the Department does not fully consider seismic risks in its design of nuclear facilities. An example is the delays caused at Hanford's Waste Treatment Plant to address the DNFSB concerns. What corrective actions have been taken?

Assistant Secretary Triay: The Department has taken several corrective actions to findings that seismic risks in its design of nuclear facilities were not being fully considered. To ensure that the Department is fully addressing seismic risks systematically, the Department's Chief of Nuclear Safety, in conjunction with the Office of Environmental Management (EM), established a Seismic Lessons-Learned Panel (Panel) in 2007. The Panel is comprised of independent industry experts, most of whom have previous experience in dealing with the DNFSB on seismic-related issues, and Department employees. This Panel provides expert advice to DOE Managers to ensure that the seismic design of nuclear facilities is conducted at the appropriate level of risk, consistent with mission and safety goals of the Department. Specifically, the Panel focuses on: (1) seismic and related structural design, (2) site geotechnical characterization and analysis, and (3) 10-year updates for state-of-the-art natural phenomena hazard assessment methodologies and site-specific information as required by Departmental directives. The Panel identified a number of issues for action along the lines of program management support, site-specific support and risk policy.

In addition, a Seismic Design Expectations Report has been incorporated into the EM Standard Review Plan (SRP). The SRP is employed during construction project reviews, and the Seismic Design Expectations Report will allow reviewers to verify that seismic hazard characterization and design are performed in accord with best practices.

8. RECOVERY ACT FUNDING ALLOCATION

Question: On what basis did you allocate Recovery funding to sites and projects?

Assistant Secretary Triay: Office of Environmental Management (EM) allocated the $6 billion of American Recovery and Reinvestment Act (Recovery Act) funding provided by Congress to support footprint reduction and near-term completion cleanup activities. The cleanup projects chosen for the Recovery Act work were selected based on criteria that would assure quick deployment of resources to maximize creation of jobs. Candidate projects needed to use proven technologies that could be implemented and completed by September 2011. Projects required an established regulatory framework with regulator and community support. Projects must have an acquisition structure in place with a contract vehicle to allow quick expansion of environmental cleanup workforces. In addition, sites needed to have the project management structure and approvals in place to track and measure performance. EM identified opportunities at 17 sites in 12 states meeting these Recovery Act criteria. Recovery Act funding was directed towards scope that could most readily be accelerated such as: soil and groundwater remediation; radioactive solid waste disposition; and facility decontamination & decommissioning.

9. JOB CREATION AND SUSTAINMENT

Question: Your programs received $6 billion in the Recovery Act. Would you please tell the Subcommittee how many current employees are involved solely in managing this funding?

Assistant Secretary Triay: Currently, the Office of Environmental Management (EM) Headquarters (HQ) has 14 Federal staff dedicated to managing Recovery Act Funding. In addition, 14 Site Representatives in the field provide advocacy and oversight for Recovery Act activities. Of the Federal employees, two were hired as term, Fiscal Year (FY) 2011, employees. Site office Integrated Project Teams are supported with 50 support contractors that are paid with Recovery Act Funds.

Question: How many people have been hired, either as Full-Time Equivalents (FTE) or contractors?

Assistant Secretary Triay: Out of the 28 Federal staff, 14 are new hires. The other Federal employees were transferred from existing positions in the EM Program or other Departmental Offices.

Question: As funding is expended, how many jobs are at risk?

Assistant Secretary Triay: In regards to the 28 Federal employees managing and overseeing the Recovery Act program, the 14 EM HQ employees will be reassigned back to their home EM HQ Organization and the 14 Recovery Act Site Representatives will be assigned to the Field Organization where they are currently located.

Question: Will you propose an increase in FTEs to keep some of them hired?

Assistant Secretary Triay: It is anticipated that through attrition and the skill set needs to support the EM Mission, all of the Recovery Act Federal employees will transition into the EM base program.

Question: We understand worker transition plans are under development to minimize lay-offs. Please describe them for the Subcommittee.

Assistant Secretary Triay: When the EM Recovery Act program is complete, the HQ Recovery Act staff will be reassigned back to their home EM HQ Organization or another mutually agreeable EM HQ Organization. Also, the Site Representatives will continue to perform in their advocacy and oversight role but will be funded by the Field Organization where they are currently located.

In regards to the contractors who will be impacted by the ramp-down of the Recovery Act, the EM Recovery Act program is currently in discussions with DOE Management and the Department of Labor to develop a path forward for EM Recovery Act worker transition post FY2011. In addition, I have directed each of the sites to assist in developing workforce transition plans to meet site specific needs.

10. IMPLEMENTATING ROOT CAUSE ANALYSIS CORRECTIVE ACTIONS

Question: In April 2008, the Department of Energy issued a root cause analysis of its contract and project management function. The analysis identified issues that, if properly addressed, could improve Department's cost and schedule performance. These included incomplete project requirements definition; insufficient numbers of federal contracting and project personnel with appropriate skills; risks not sufficiently identified, assessed, communicated or managed; contracts often awarded prior to the development of an adequate independent government estimate; and the Department not ensuring that its project management requirements are consistently followed. In July 2008, the Department issued a corrective action plan to address these issues. To what extent have the actions in the corrective action plan been implemented by the Office of Environmental Management (EM)? How will EM determine whether the corrective actions have been effective at addressing the problems identified?

Assistant Secretary Triay: I am committed to implementing the corrective actions identified in the Root Cause Analysis. The Office of Environmental Management (EM) is currently restructuring its project portfolio into capital projects and operational activities to better manage and track performance.

As a result of the *Root Cause Analysis,* EM has adapted and implemented the Project Definition Rating Index (PDRI) tailored for EM projects from the Construction Industry Institute guides as well as the Technology Readiness Assessment (TRA) methodologies developed by the National Aeronautics and Space Administration to provide consistent and rigorous standards for requirements definition. Also, EM assembled a cross-functional team with representatives from the field and headquarters that provided the Department the momentum to move forward in developing and updating risk management training, processes, procedures, and guidance. Further, EM is making progress toward improving the training and certification levels of Federal Project Directors and procurement professionals.

EM has initiated Construction Project Reviews which examine all aspects of a project, including project management, technology, and engineering. The reviews are intended to assess the program and overall health of the project regarding the ability to meet cost and schedule goals. The reviews allow EM to proactively reduce project risk so that issues and solutions can be identified early rather than react once project risks are realized.

11. GAO GUIDANCE

Question: In a 2005 report, the Government Accountability Office recommended that the Department of Energy develop a long-term sustainable approach to reduce long-term maintenance costs, including implementing sustainable day-to-day maintenance requirements, reducing the maintenance backlog, and minimizing its re-accumulation. The Office of Engineering and Construction Management (OECM) has issued guidance to address these issues. What has been EM's progress in implementing these programs?

Assistant Secretary Triay: The Office of Environmental Management (EM) is implementing guidance provided by OECM as detailed in DOE Order 430.1B, *Real Property Asset Management* and associated reporting guidance. During the period Fiscal Year (FY) 2005 through FY 2009, EM's deferred maintenance backlog decreased by approximately six percent while, concurrently, overall maintenance spending decreased by about 42 percent. Since FY 2007, EM has targeted its maintenance spending on operating assets while keeping inactive assets in a safe and secure mode. While FY 2009 maintenance spending on operating assets was approximately 39 percent higher in FY 2007, on these same assets the deferred maintenance backlog increased by approximately 63 percent. Improved condition standards and inspection techniques contributed to the increase in deferred maintenance and increased maintenance spending is expected to drive down the maintenance backlog.

Utilizing almost 50 percent of the $6 billion American Recovery and Reinvestment Act (Recovery Act) funding, EM's planned demolition goal under Recovery Act is more than three million square feet. Decontamination and decommissioning these excess facilities will result in additional reductions of long-term maintenance costs.

12. MANAGEMENT CULTURE

Question: In reports on the Department of Energy's project management, both the National Research Council and Government Accountability Office have noted that improved performance on the Department's projects would require an organizational and cultural change within the Department. What steps have you taken to help ensure that such a change in culture occurs and to hold the Office of Environmental Management's managers accountable for successful execution of projects that meet cost, schedule, and technical performance goals?

Assistant Secretary Triay: The Office of Environmental Management (EM) has taken several actions to facilitate the organizational and cultural change needed for improving project performance. I have made project performance one of the key priorities in my vision for EM's "Journey to Excellence." I have committed to assuring that all EM projects and activities are on schedule and within budget. I increased the level and frequency of senior management project reviews to give greater visibility and priority on project performance and timely resolution of issues when I restructured the organization in October 2009. I also established a dedicated Deputy Assistant Secretary for Project Management to provide added attention and focus on improvement who also reports directly to me as the Executive Secretariat for the EM Acquisition Board. EM established metrics for project performance and improvement that are being tracked regularly by senior EM and DOE leadership. The key metrics are contained in my performance plan and in the performance plans of EM project management leadership and staff to make sure managers are personally accountable.

13. COST ESTIMATING POLICY

Question: The Government Accountability Office (GAO) also reported that the cost estimates for the four projects reviewed did not exemplify the four characteristics of high-quality cost estimates as established by best practices—credible, well-documented, accurate, and comprehensive. Three of the estimates, for example, did not include costs associated with the full life cycle of the projects. What steps is the Office of Environmental Management taking to ensure that its cost estimates are comprehensive so that Congress and taxpayers are adequately informed about the potential costs of these projects?

Assistant Secretary Triay: The Office of Environmental Management (EM) established the Office of Cost Estimating and Analysis (CE&A) at the Environmental Management Consolidated Business Center (EMCBC) in 2007 to improve our corporate cost estimating capability. The mission of the EM CE&A Program is to: 1) establish standards, policy, and procedures to assure that EM cost and schedule estimates are accurate, traceable, and reliable; 2) provide Independent Cost Estimating (ICE) and Independent Cost Analysis (ICA) capability to support EM acquisition and project management program requirements; 3) provide independent cost estimating and analysis support to EM management, the EM Acquisition Advisory Board (EMAAB), and EM budget formulation processes; and 4) lead the development and management of cost and schedule databases, methodologies, and tools needed by EM to improve and standardize its cost estimating and analysis capabilities.

During Fiscal Year (FY) 2009, this office completed 27 Independent Government Cost Estimates (IGCE) with an aggregate value over $4.6 billion dollars. In addition, 93 percent of these cost estimates were within 25 percent of the final contract award amounts, and 100 percent were completed within established schedules. An additional 34 Independent Cost Analyses were performed to support evaluation of contractor-submitted Requests for Equitable Adjustment, contract or baseline change proposals, and validate EM site-specific performance measurement baselines.

During FY 2009 while supporting EM's American Recovery and Reinvestment Act Program, IGCE, valued at more than $3 billion in total project costs at 14 EM project sites, were completed. Independent Review & Validations (IR&Vs) of Government Cost Estimates developed by EM Field Offices were also completed at a value of nearly $3 billion in total project costs.

In the last year, EM has established three specific cost estimating policies and procedures to refine the EM Cost Estimating processes to be consistent with established industry best practices that result in high-quality cost estimates that are comprehensive, accurate, easily and clearly traced, replicated, and updated. They are: 1) EM IGCE Policy consistent with established Federal Acquisition Regulation government cost estimate requirements; 2) EM IR&V procedure that is used to standardize the process for evaluating and validating both Government and contractor-generated cost estimates and proposals; and 3) EM Basis of Estimate procedure that provides a standardized method of documenting the critical aspects of a project cost estimate.

Consistent with DOE's Contract and Project Management improvement initiatives, and to continuously improve EM's performance related to contract and project management, EM completed the development and deployment of EM's Environmental Cost Analysis System (ECAS). ECAS is a web-based system that is used to collect, organize, store, and report historical cost data from completed EM cleanup projects. ECAS contributes to EM's ability to improve accuracy, traceability, and reliability of EM cost and schedule estimates, and support benchmarking needed to perform cost reviews on contractor submitted estimates. To date, ECAS includes the Rocky Flats Closure Project, Fernald Closure Project, Miamisburg Closure Project, Oak Ridge's Melton Valley Environmental Restoration Project, and 19 smaller remediation projects, representing a collection of more than 150 individual EM cleanup projects. In support of the Department-wide cost estimating improvement initiative, including the goal of developing a DOE cost database (*i-Cost*), the ECAS cost data has been provided to the Office of Cost Analysis.

In the recently published GAO report titled *Actions Needed to Develop High-Quality Cost Estimates for Construction and Environmental Cleanup Projects*, the GAO recognized that EM had recently placed cost estimators at our EM Field Offices and established an internal cost-estimating office at the EMCBC that was capable of providing cost estimating support to the whole EM organization. The GAO also reported that "*EM's cost-estimating office has already conducted a number of independent estimates and reviews, including many to support EM's American Recovery and Reinvestment Act work. It has also built a database—Environmental Cost Analysis System—containing historical actual costs from two of EM's cleanup projects and has helped develop a standard way of organizing work scope within a project to ensure all cleanup projects collect actual costs in a way that is consistent with the new database*" (GAO-10-199, p. 25-26).

14. TARGET FOR COST ESTIMATING

Question: A performance measure in the July 2008 Root Cause Analysis was for 90% of capital asset and operating costs to be within 10% of cost estimates. Does the fiscal year 2011 request meet this milestone?

Assistant Secretary Triay: The majority of the capital asset cleanup projects contained in the Fiscal Year (FY) 2011 budget request meet this metric comparing their cost performance against the approved cost baselines.

Question: Which Office of Environmental Management projects exceed the 10% cost estimate threshold?

Assistant Secretary Triay: Of the 67 capital asset projects in the FY 2011 request, 60 projects are projected to complete within 10% of their original approved cost estimates.

There are seven projects which are expected to exceed the 10% threshold in the FY 2011 Request. Two of these, the Depleted Uranium Hexafluoride Conversion Project and the Sodium Bearing Waste Treatment Facility will be complete in FY 2011. The remaining five projects are the: Waste Treatment and Immobilization Plant at the Office of River Projection, Downblending of U-233 in Building 3019, Nuclear Facility Decontamination and Decommissioning at the East Tennessee Technology Park at Oak Ridge, Salt Waste Processing Facility at Savannah River Site, and Canon De Valle at Los Alamos National Laboratory. Those projects that were rebaselined are meeting their newly established performance baseline and their associated funding profiles are supported by the FY 2011 budget request.

These projects' cost baselines were established prior to the July 2008 Root Cause Analysis. The lessons learned from these projects, especially with regard to risk management and contingency planning, have been incorporated into the project management and cost estimating procedures to assure the success of future projects.

15. INDEPENDENT COST ESTIMATES

Question: The Department's Office of Engineering and Construction Management (OECM) is responsible for independently validating that Environmental Management cost and schedule project baselines can be successfully accomplished. However, according to the Government Accountability Office, OECM does *not* conduct Independent Cost Estimates (ICE) at critical decisions (CD) 2 and 3?

Assistant Secretary Triay: The Department's pending cost estimating order (415.X) will require independent cost estimates for major projects prior to approval of Alternative Selection and Performance Baseline (milestones 1 and 2). These independent cost estimates will be consistent with the project phase. For milestone 1, the Department will identify a cost range using parametric cost methods (or extrapolation from actual costs for similar projects when available). For milestone 3 – start of construction – DOE will conduct an independent cost estimate if warranted by risk and performance indicators or required by senior officials.

Question: In the Department's response to the GAO report, it disagreed with the recommendation to conduct ICE on major projects that have passed CD-3. Wouldn't an accurate estimate be better sooner rather than later during construction?

Assistant Secretary Triay: The Office of Environmental Management (EM) continuously monitors project performance using established Earned Value Management (EVM) techniques. When using EVM, a project's performance is measured against its performance measurement baseline. Depending on the project's cost threshold, the performance baselines have been independently validated by OECM through the Departmental External Independent Review (EIR) process or by EM through the Independent Project Review (IPR) process. Once an EM project receives CD 2 approval, EM works with OECM on a continuous basis to monitor and evaluate the most up-to-date project performance data and indicators. If the indicators identify performance trends that exceed established performance expectations (i.e., trending toward poor performance), EM can request the OCA or EM's Office of Cost Estimating & Analysis to perform an ICE.

DOE O 413.3A also requires OECM, supported by OCA, to perform a Construction or Execution Readiness EIR for all Major System Acquisition (MSA) projects (i.e., projects with a TPC equal to or greater than $750 million) prior to CD 3. The purpose of the EIR is to assess the readiness for construction or execution and to confirm the completeness and accuracy of the performance baseline. During this EIR, an Independent Cost Review (ICR) or ICE may be performed as appropriate or requested. For Non-Major System Projects, EM will perform Independent Project Reviews, which will include a rigorous ICR. Depending on the projects complexity or identified project risk, an ICE can be requested by either the Federal Project Director, or the Acquisition Executive.

Question: What is the Office of Environmental Management (EM) doing to improve the cost estimating of its capital construction and operating projects at CD-2 and CD-3, respectively?

Assistant Secretary Triay: During Fiscal Year (FY) 2010, EM's Office of Cost Estimating & Analysis plans to issue an EM-specific Cost Estimate Development Practice, Basis of Estimate Procedure, Cost Estimate Review Procedure, and EM Cost Estimating Guide. These documents will enable EM to standardize cost estimating practices across the EM complex. This guidance, combined with policies and procedures developed last year are laying a solid foundation to improve EM's cost estimating practices.

As a result of EM's Best-in-Class Project Management (BICPM) initiative, EM has allocated additional FTEs for cost estimators across the program. When federal resources are not available, EM has supplemented the federal staff with professional cost estimators through an Inter-Agency Agreements with the U.S. Army Corps of Engineers.

EM has made a commitment to train our federal cost estimators. For example, most if not all of EM's cost professionals have attended the first OCA-sponsored DOE Cost Estimating Course. Additionally the EM Office of Cost Estimating & Analysis has sponsored at least two EM corporate cost estimating training sessions annually since that office was established in 2007.

EM has adopted the use of the Environmental Cost Element Structure (ECES), a standardized, comprehensive, hierarchical list of elements that might be required to accomplish environmental projects. ECES is comprised of activities conducted throughout the life-cycle of a project or program and the essential parameters that impact project cost and schedule. It includes new and baseline technologies, environmental restoration, waste management, decontamination and decommissioning (D&D), long-term stewardship, and other tasks. The ECES was developed jointly with the Federal Remediation Technologies Roundtable's (FRTR) Environmental Cost Engineering Committee (EC^2). EC^2 members include the Army Environmental Center (AEC), DOE EM, Environmental Protection Agency (EPA), US Navy, US Air Force, and Naval Facilities Engineering Command.

Question: Some have pointed out that a full ICE for projects that are performing well at CD-2 and CD-3 shouldn't be required. The problem with this approach is that those of us outside the Department who are responsible for funding wouldn't be part of deciding which ones are performing well, and which ones are not. What assurances can you provide that such an analysis would be complete, impartial, and consistent across projects? What, if any, projects within EM do not currently have ICEs at CD 1, 2, and 3?

Assistant Secretary Triay: To track project performance, the Department is deploying an upgraded version of the Project Assessment and Reporting System, known as PARS II, to provide accurate, timely, complete, and verifiable project performance data. The system will allow greater transparency on the performance of specific projects and will facilitate the efforts of programs and oversight staffs to analyze, track, and validate the data in a complete, impartial, and consistent manner. The data will be provided electronically, directly from our contractors' project management systems. This is intended to eliminate errors and delays inherent in the existing system and improve data reliability, which has been of concern to the GAO.

In accordance with DOE Order 413.3A, the Department conducted an Independent Cost Review (ICR) for major projects as part of the performance baseline validation external independent review performed by the Office of Engineering and Construction Management. The following major projects have not received an Independent Cost Estimate (ICE) at Critical Decisions 1, 2, and 3:

- Waste Treatment and Immobilization Plant (WTP) at the Office of River Protection
- Salt Waste Processing Facility (SWPF) at Savannah River Site (at CD-3 only)

The Department's pending cost estimating order (415.X) will require ICE for all major projects prior to approval of Alternative Selection and Performance Baseline. EM will fully comply with this requirement by partnering with OCA to obtain the required ICEs. Depending on the thresholds defined in DOE O 413.3A, the performance baselines are independently validated either by OECM using established Departmental EIR practices or by EM's Office of Strategic Planning & Analysis using established Independent Project Review (IPR) practices. Once an EM project receives CD-2, EM works with OECM on a continuous basis to monitor and evaluate project performance data and indicators. If the project's trending toward poor performance, EM can either request OCA or EM's Office of Cost Estimating & Analysis to perform an ICE.

During FY 2009 EM partnered with the OCA to perform an ICE on the Savannah River (SR) Salt Waste Processing Facility (SWPF) project prior to obtaining CD 3 approval. For all of EM's Major Acquisition Projects, an OECM-sponsored EIR was completed in accordance with DOE O 413.3A requirements. During each EIR the cost estimate (or cost baseline) was validated prior to obtaining either a CD 2 or CD 3 approval. For Non Major Acquisition Projects, EM-HQ led Independent Project Reviews (IPR) was conducted prior to approval of CD 0, CD 1, and CD 2. During these IPRs, the EM Office of Cost Estimating & Analysis conducted a thorough cost estimate (or cost baseline) review and validation.

16. OFFICE OF COST ANALYSIS AND ENVIRONMENTAL MANAGEMENT

Question: The Office of Cost Analysis (OCA) has been established to improve the cost-estimating at the Department. What mechanisms are in place to work with OCA and how would you characterize your interaction with OCA to date?

Assistant Secretary Triay: EM is actively working with the Office of Cost Analysis (OCA), who has overall DOE corporate cost estimating responsibility, by providing historical project cost data that is being evaluated during the development of the DOE cost database (*i-Cost*). EM has migrated the ECAS project and cost data for the Rocky Flats Closure Project, Fernald Closure Project, Miamisburg Closure Project, Oak Ridge's Melton Valley Environmental Restoration Project, and 19 smaller remediation projects, which represents a collection of more than 150 individual EM cleanup projects to OCA.

EM and OECM are participating in an OCA-sponsored pilot project, to capture actual ongoing project cost data and secondary project parameters for seven of EM's largest projects. The OCA pilot project will collect project parameters and actual cost data to the appropriate level. The EM projects are: ORP Waste Treatment Plant (includes 5 major subprojects), SR SWPF project, RL Soil and Groundwater Remediation Project, Paducah Nuclear Facility Decontamination and Demolition, ID Solid Waste Stabilization and Disposition (includes the Advanced Mixed Waste Treatment Project), Nuclear Facility D&D - East Tennessee Technology Park (D&D Fund), and Radioactive Liquid Tank Waste Stabilization and Disposition - ORP (tank farm). The OCA pilot project is the precursor to developing a DOE-wide cost estimating database (*i-Cost*).

OCA holds monthly meetings with the Department's Program Secretarial Offices (PSO) to provide the status of ongoing DOE cost estimating initiatives and solicit input as that office develops DOE's cost estimating policies and practices. EM Federal cost estimators have joined the DOE Cost Estimating Community of Practice, hosted by OCA, and actively participate on the cost estimating community that was established on DOE's *i-Portal*. This online community is an avenue for DOE Federal cost professionals to share best practices and lessons-learned.

17. CATEGORIZATION OF PROJECTS FOR MANAGEMENT PURPOSES

Question: The Office of Environmental Management (EM) is in the process of implementing a new categorization of projects to improve project management. Larger projects are going to be broken down into smaller, more manageable constituent elements. This seems reasonable but could you share with the Subcommittee your rationale for doing this and how it will help with project management?

Assistant Secretary Triay: The direct application of DOE O 413.3A, Program and Project Management for the Acquisition of Capital Assets, to the entire EM program has served EM well in becoming more focused, efficient, and results-oriented. EM will continue to embody those principles in the conduct of business operations. The new structure of the EM program is based on and more succinctly aligned with existing Federal and Departmental asset management requirements. The shift toward smaller capital projects will move the program toward a more performance-based program. Establishment of smaller capital projects will allow EM to develop performance baselines with clearer scope definition, develop more defensible project cost estimates, identify schedules with realistic end dates, have a greater understanding of project risks and opportunities, and achieve more successful project completions.

Question: Please provide to the Subcommittee a summary of the proposed re-categorization.

Assistant Secretary Triay: The following three categories in the EM program have been instituted.

1. Construction Projects: This category includes capital asset projects being executed as line item construction projects and miscellaneous minor new program-specific or general construction projects whose total estimated cost is equal to or greater than the threshold for General Plant Projects and Institutional General Plant Projects.

2. Cleanup Projects: This category includes capital asset projects being executed as cleanup projects. This involves the construction phase of environmental restoration (i.e., soil and water remediation) and facility decommissioning and demolition.

3. Operations: This category includes non-capital asset activities including: the stabilization, packaging, storage, transportation and disposition of waste and nuclear materials; the operation of environmental remediation systems such as groundwater treatment systems; post-construction and post-closure care of remediated land burial sites; long-term environmental stewardship including environmental monitoring and institutional controls; and facility shutdown and deactivation activities designed to place the inactive structures, systems and components in a safe and stable configuration pending final decommissioning. Other EM activities in this category include: landlord activities and site services such as infrastructure maintenance; safeguards and security; emergency management; land management; fleet (vehicle transportation) management; technology research, development, demonstration and deployment; community-support grants;

public outreach, regulatory oversight grants; preservation of cultural resources, and program management.

Question: This approach would entail this Subcommittee funding smaller, more discrete portions of much larger projects. I'm concerned about large projects that face potential technical challenges in out-years. I could see a situation in which we would fund several years of discrete, easily managed portions, but then be hit with a roadblock farther down the road. How will EM provide us assurances that we're not funding smaller chunks that might get wasted because of problems down the road?

Assistant Secretary Triay: The focus during the project "chunking" effort was to develop complete and usable projects. An additional emphasis has been placed on ensuring that the "chunking" process does not create orphan projects. All projects will follow the Critical Decision (CD) process established in DOE Order 413.3A. As each CD is reviewed and approved by the Acquisition Executive, an evaluation of the project will be conducted to assure the appropriate technology is available for the projects and any risks that could impact project success have been addressed.

18. EARNED VALUE MANAGEMENT SYSTEM

Question: According to your budget documents, over 90% of Office of Environmental Management contractors are using a certified Earned Value Management System (EVMS). Which contracts and sites are *not* currently employing an EVMS?

Assistant Secretary Triay: Of the 28 contractors requiring DOE EVMS certification, the following contractors are not certified:

Paducah - Paducah Remediation Services (PRS)

Paducah & Portsmouth - Uranium Disposition Services (UDS)

Savannah River - Savannah River Remediation (SRR)

These three are new contracts that are now undergoing the certification process.

19. STAFF VACANCIES

Question: Increases in program direction in recent years support stronger headquarters management and oversight over the field. The budget request cites 1,647 FTEs planned. How many vacancies are currently unfilled?

Assistant Secretary Triay: As of March 25, 2010, there were 42 vacancies within Environmental Management (See the chart below for specific vacancy locations).

Site/Office	Number of Vacancies
CBFO	4
EMCBC	10
EM Headquarters	7
ID	1
ORP	8
PPPO	3
RL	8
Small Sites	1
SRS	0
EM Vacancy Total	42

20. STAFF EXPERTISE AND RETENTION

Question: Are you having any issues finding staff with the necessary expertise to manage large projects and contracts?

Assistant Secretary Triay: Like other federal agencies and departments, certified project managers and acquisition professionals pose a challenge with respect to recruiting and retention. The Department of Energy is aggressively pursuing many techniques such as creative Web site advertising and targeted recruitment programs to increase the size and quality of our acquisition workforce. For example, Environmental Management recently developed a Web-based recruitment video showcasing careers in Environmental Management.

Question: What disciplines or series titles are the most challenging from a recruiting and retention standpoint?

Assistant Secretary Triay: Project management and acquisition areas represent our biggest challenge.

21. OVERALL FUNDING HANFORD SITE

Question: The fiscal year 2011 budget request for Hanford is $969 million, a decrease of $21 million from the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: EM anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are you in compliance with the Tri-Party Agreement?

Assistant Secretary Triay: Yes, with the requested budget, EM anticipates being in compliance with the Tri-Party Agreement.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines and penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

22. OVERALL FUNDING OFFICE OF RIVER PROTECTION

Question: The total Office of River Protection fiscal year 2011 budget request is $1,158 million, an increase of $60 million from the fiscal year2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: EM anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are you in compliance with the Tri-Party Agreement?

Assistant Secretary Triay: Yes, with the requested budget, EM anticipates being in compliance with the Tri-Party Agreement as modified by the proposed Consent Decree requirements.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

23. WASTE TREATMENT PLANT AND TANK WASTE

Question: In an August 2009 Departmental review of the Waste Treatment Plant's (WTP) cost and schedule, the review team was unable to validate that the construction project will be completed on time or within estimated cost. The review team noted that the cost estimate does not include a complete assessment of project risk. Similarly, in September 2009, the Government Accountability Office (GAO) reported that the estimated cost to cleanup the Hanford tank waste could significantly exceed the Department's current estimate of $77 billion, with estimates ranging from about $86 billion to over $100 billion, depending upon the date cleanup is completed. Why have you been unable to formulate and meet WTP cost and schedule baselines?

Assistant Secretary Triay: The Waste Treatment and Immobilization Plant (WTP) construction project is one part of the Hanford tank waste cleanup activity managed by the Department. The WTP cost and schedule baseline was developed following several independent reviews in 2005 and 2006. DOE and the contractor integrated the findings and recommendations of those reviews into a revised estimate in cost and schedule, which were subsequently incorporated into a revised baseline that the Deputy Secretary approved in December 2006. Since approval of that performance baseline, the project has utilized an appreciable amount of management reserves and DOE contingency to address emerging issues; however, the project continues on this performance baseline.

Due to the magnitude of the WTP project and its complex interrelated systems and equipment, WTP has experienced numerous technical challenges that have required use of project reserves in cost and schedule to address these issues on a first-of-a-kind project. All of the major technical issues are scheduled to be resolved this summer. This will allow engineering to continue to progress toward completion of design, which in turn will reduce project risks. Besides normal construction risks, labor and material, the most significant risks going forward will be in commissioning the plant. Plans are being developed now to limit the risks that could occur during commissioning.

Question: How much will the project cost to complete, when will it be completed, what contingency is needed, and what assurances can you provide that the project will not exceed these estimates?

Assistant Secretary Triay: The current cost estimate to complete the project remains at $12.263 billion with a completion date of 2019, which is the current performance baseline. Some funding alternatives are being evaluated that could decrease project risks to the project being completed on time and within the approved performance baseline. DOE management has been engaging the contractor on a continuous basis to assure that all issues are resolved as expeditiously as possible.

Question: What steps is the Office of Environmental Management (EM) taking to address the recommendations made by the review team such as 1) dedicated Headquarters support for the project, 2) unambiguous authority, 3) clearly defined responsibility and accountability of the

Federal Project Director, and 4) realignment of the Office of River Protection site staff to more effectively support the Federal Project Director and the Project Execution Plan?

Assistant Secretary Triay: EM has taken the step to assign a Headquarters (HQ) sponsor to serve as a direct report between the WTP Federal Project Director and senior EM management. This HQ sponsor has responsibility for championing and resolving project issues at HQ, as well as assisting the site with various issues and interfaces with other departments. Additionally, EM senior management established monthly management meetings with the WTP contractor's senior corporate managers to review the status and path forward of key issues, such as resolution of technical issues. At Hanford, the Department's Office of River Protection (ORP) has taken steps to realign resources to better serve the mission of the project. This realignment, as recommended by the CPR team, will allow for better focus in key areas and better management of the project. The realignment initiative include hiring Deputy Federal Project Directors for each of the major WTP facilities and providing dedicated support to the WTP project from the ORP offices of Engineering and Nuclear Safety and Acquisition Management.

24. WASTE TREATMENT PLANT RISK

Question: In January 2009, the Defense Nuclear Facilities Safety Board (DNFSB) reported deficiencies in the functional requirements for the WTP's waste mixing and transport systems. Specifically, the DNFSB raised concerns that, as currently designed, the pulse jet mixers would not sufficiently mix the waste, allowing radioactive wastes to accumulate on the bottom of the tanks and create the potential for a criticality accident to occur. How seriously is EM taking this concern?

Assistant Secretary Triay: The Office of Environmental Management (EM) takes this DNFSB concern and all safety concerns, very seriously. The DNFSB letter raising these issues was based upon DNFSB staff interactions with the Department of Energy Office of River Protection (ORP) and WTP Contractor, Bechtel National Inc (Bechtel), staff in June, September, October, and December 2009. The report reflects the issues ORP and Bechtel discussed with the DNFSB staff, identified from testing completed during that time frame, that the current design for some of the components required to mix WTP vessels may lack sufficient power. This has the potential to adversely affect the ability of those vessels to adequately mix and transport the most challenging fraction of the waste particles expected to be present in the Hanford waste inventory.

Since reaching that conclusion, ORP and WTP have reassessed the additional testing and analysis needed to improve the capability of the Pulse Jet Mixer (PJM)-mixed vessel designs. Discussions were held with the DNFSB and their technical staff on the concerns raised in their January 2010 letter and the actions being taken to resolve them, during a visit to the Hanford Site the week of March 15, 2010.

Question: What is EM doing to address this issue?

Assistant Secretary Triay: To address the issue of PJM mixed vessel designs, EM has developed a comprehensive strategy to: (1) establish functional requirements and technical criteria for safe operation of the integrated WTP pulse jet mixing, transport, and sampling systems; (2) establish bounding design basis requirements for particle size and density based on feed qualification capabilities; (3) develop design methods that demonstrate that system performance can meet functional requirements with bounding design basis inputs; and (4) establish a criticality safety strategy that reflects the capabilities of the mixing, transport and sampling systems. Testing to validate necessary mixing design improvements and to underpin changes to the criticality safety strategy is in progress and projected to be completed June 2010.

Additionally, the WTP contractor has proposed a backup strategy that will allow for rerouting some of the more challenging wastes, less than five percent total, to vessels that have demonstrated the ability to mix such wastes.

Question: What is the cost estimate to fix this problem?

Assistant Secretary Triay: To date, $45 million has been spent on testing related to suspending and mixing fast settling solids with PJM technology. The forecast for work remaining to identify solutions to this issue is $11 million. Preliminary conceptual estimates for required modifications range from $50 million - $125 million depending upon the outcome of testing and the extent of modifications to vessels and plant required.

25. WASTE TREATMENT PLANT RISK

Question: About one-third of the radioactivity of Hanford's tank waste (mainly cesium and strontium) is stored in about 1,900 steel canisters on site. What is EM's plan for treating this highly radioactive waste?

Assistant Secretary Triay: DOE anticipates that disposition of cesium and strontium from these canisters will be added to the Waste Treatment and Immobilization Plant (WTP) treatment process and create the need for additional waste canisters.

Question: Why is this waste not part of the WTP's project's scope?

Assistant Secretary Triay: There is currently a Hanford TPA milestone (M-92-05) which is to "determine the disposition path and establish interim milestones for Hanford Site Cs/Sr capsules" due date June 30, 2017. The milestone will entail evaluating direct disposal at a High Level Waste Repository. In all the action alternatives analyzed in The Draft Tank Closure and Waste Management Environmental Impact Statement (TC&WM EIS), issued for comment in December 2009, the cesium and strontium waste are assumed to be processed and vitrified in WTP. The immobilization of cesium and strontium capsule waste would take place during a separate campaign, after treatment of all tank High Level Waste is completed in the WTP. A capsule processing facility would need to be built so that processing of cesium canisters could begin approximately 14 months prior to the completion of WTP processing of tank HLW. The No-Action alternative analyzes the impacts for indefinitely storing the cesium and strontium capsules in the Waste Encapsulation Storage Facility (WESF), in a manner similar to the present. Although the draft TC&WM EIS provides the NEPA evaluation for utilizing the WTP, the document is clear that the disposition of Cs/Sr capsules is not a decision the draft TC&WM EIS is making at this time.

26. PRETREATMENT PLANT TESTING

Question: In a 2009 report on the Department's technology development program, the National Academy of Sciences notes that it presents risk relying on computer simulations to predict waste processing outcomes, rather than pilot-scale testing with simulants. At the WTP, how is EM ensuring that the Pretreatment Plant—the first of its kind—will work as planned without fully testing the technologies in an integrated pilot plant?

Assistant Secretary Triay: At the WTP, EM is not relying exclusively on computer-based simulations to predict waste processing outcomes. Rather, EM has adapted the Department of Defense technology maturation process for DOE use and has already conducted an extensive testing program to underpin the Pretreatment Plant design. Both real waste and waste simulants are used for bench scale testing, while waste simulants alone are used for pilot scale tests. Examples of pilot scale testing supporting the Pretreatment Facility design include:

1) Pretreatment Engineering Platform Testing – DOE and the contractor had constructed and implemented an integrated test platform to demonstrate core pretreatment leaching and ultrafiltration unit operations with waste simulants. This testing program was completed successfully;

2) Ion Exchange Process Testing – The contractor used pilot scale testing to demonstrate the proposed resin ion exchange technology and was completed successfully; Line Plugging Testing - Pilot scale testing with waste simulants was performed and completed successfully to confirm the adequacy of piping designs for waste slurry transport piping;

3) Pulse Jet Mixer (PJM) Operation - Pilot scale testing was conducted with waste simulants to evaluate planned technology for PJM operation and completed successfully;

4) Erosion of Metal Components - Pilot scale testing was conducted with waste simulants to evaluate erosion of metal components (tank –bottoms and structures) using pressure washing techniques and successfully completed establishment of related design margins;

5) Waste Sampling - Full scale testing of autosampler technology was conducted with waste simulants to validate design and completed successfully; and

6) PJM Mixing – Successfully completed pilot scale testing with waste simulants to underpin the design of vessels processing of certain waste types. The project is currently completing pilot scale testing with waste simulants to validate design improvements for vessels processing wastes with rapidly settling particulate.

EM plans to evaluate the need for further integrated or larger scale testing of WTP vessel mixing, transport, sampling and control & instrumentation systems as a risk mitigation activity. This evaluation will be completed after the current PJM mixing tests are completed and evaluated.

27. TANK SAFETY

Question: By 2019, when the WTP is currently scheduled to begin treating waste, the age of Hanford's tanks will range from more than 30 years to nearly 75 years, but the waste in many of these tanks will not be retrieved for many years after operations begin. What is EM's strategy for ensuring that the tanks can continue to safely store the waste without further leakage to the ground before waste retrieval?

Assistant Secretary Triay: The Office of Environmental Management (EM) has a robust double-shell tank integrity program to monitor the condition of the tank liners and extend the useful life of these newer tanks. EM commissioned a single-shell tank (SST) integrity expert panel to evaluate the condition of the aging SSTs and provide recommendations regarding future tank integrity evaluation, monitoring, and use. EM will collaborate with State of Washington regulators to establish a long-term SST integrity program based on the imminent conclusions from this industry expert panel.

28. TANK CAPACITY

Question: In September 2009, GAO reported that it is unclear whether EM can increase its tank waste retrieval rate to adequately supply waste to the WTP on a continuous, long-term basis when the plant begins operating in 2019, as currently planned. From 2003 through 2009, EM emptied 7 single-shell tanks—about 1 tank per year. According to an August 2009 tentative legal settlement, EM has agreed to retrieve 10 tanks over the next 5 years—or an increase to 2 tanks per year. Even if EM is successful in retrieving this number of tanks, it is uncertain whether sufficient space is available in the double-shell tanks to hold this waste. Further, according to EM officials, to provide adequate waste feed to the pretreatment facility, waste retrieval will need to increase to an average of 5 to 7 tanks per year when operation of the waste treatment plant begins. What steps is EM taking to increase its tank retrieval rate?

Assistant Secretary Triay: The Office of Environmental Management (EM) has developed a comprehensive schedule to improve retrieval rates in the C Tank Farm to meet proposed Consent Decree requirements. In the intervening years between now and 2014, actual waste retrieval activities in C Farm will increase up to five tanks per year. EM is also providing funding to increase infrastructure development activities to facilitate improved retrieval rates following the C Tank Farm work. The higher retrieval rates are challenging but much was accomplished in past years to develop the technologies that can now be applied to increase retrieval rates.

Question: What steps is EM taking to ensure that there is adequate space in the double-shell tanks to hold waste from its single-shell tanks?

Assistant Secretary Triay: EM has a number of efforts underway to increase the ability of the double-shell tanks to receive the waste from single-shell tank retrieval activities. These include increasing tank liquid evaporation capabilities, evaluating safe sludge storage improvements, and increasing the maximum level of selected tanks. EM is also researching other waste treatment technologies to improve the waste treatment capabilities and schedule. These efforts could more quickly free up valuable tank space as the Waste Treatment and Immobilization Plant begins treating tank waste.

29. CONTRACT NEGOTIATIONS

The contract for the construction of the WTP was recently renegotiated and re-incentivized after the contractor was significantly behind schedule and over cost. How does EM avoid the perception that the contractor has been rewarded for poor performance?

Assistant Secretary Triay: The incentive structure in the Contract prior to modification in January 2009 was not aligned with the December 2006 project baseline. The Contract was modified at that time for the following reasons:

A Cost-Plus-Incentive-Fee (CPIF) contract type became ineffective over a performance period that expanded to nearly two decades. As originally structured, with fee earned a completion, there was no immediacy of fee with respect to current performance. This necessitated a fee re-structuring.

The December 2006 project performance baseline and revised period of project completion left an eight-year "fee gap" in the WTP contract where no incentives (including cost control) were paid. As renegotiated, the Contract now includes short-, intermediate-, and long-term incentives for performance, cost, and schedule control.

Under the Changes clause and federal contract law, the Contractor was entitled to equitable adjustments (both additional fee and adjustments in Target cost) for both directed and constructive contract changes that had occurred. The modification provided equitable adjustment for these events. No fee was given for Contractor-caused cost and schedule impacts.

30. TREATMENT TECHNOLOGY

Question: Despite plans to build the Waste Treatment Plant (WTP), it will not be able to treat all of the waste. In fact, up to 50 percent or more of the planned low-activity waste currently has no treatment path. Although it has not fully tested the range of supplemental treatment options, the Department agreed in a recent legal settlement to pursue the most expensive treatment, vitrification, to address this waste. Other sites use lower-technology, lower-cost treatments, such as a cement substance called cast stone, to address their low-activity waste. Why did the Office of Environmental Management (EM) agree to pursue a higher cost treatment technology at Hanford? How necessary is this more expensive treatment form?

Assistant Secretary Triay: In 1992, DOE began preparation of a Tank Waste Remediation System EIS that resulted in a decision in 1994, as part of the "Hanford Federal Facility Agreement and Consent Order Fourth Amendment" to select extensive pretreatment of the low-activity waste stream to remove radionuclides followed by vitrification as the preferred approach. DOE performed a subsequent cost analysis for pretreatment and disposal of low-activity waste in 2003 that identified vitrification and associated disposal costs as essentially the same as other treatment methods. In late 2009, DOE issued a Draft Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site. It includes an analysis of an alternative for treating some tank wastes with a grout-like material, instead of vitrification. The draft EIS also presents costs associated with integrated scenarios of WTP operation for much of the waste, supplemental treatment for wastes not treated in WTP and specific closure scenarios. These estimates indicate that supplemental treatment of wastes via vitrification is comparable to that of grout for such wastes.

31. FACILITY STATUS AND COST

Question: DOE has recently suggested that commissioning part of the WTP—specifically, the low-activity waste vitrification facility, analytical laboratory and other facilities—may occur in 2015. Current plans are to commission the more complex facilities—the Pretreatment and High-Level Waste vitrification facilities—by 2019. Does EM have an interim plan to use the low-activity vitrification facility and analytical lab once they are commissioned in 2015, or will these facilities sit idle until the entire plant is commissioned?

Assistant Secretary Triay: Construction of the low-activity waste (LAW) facility and the Analytical Laboratory are scheduled to be complete in Fiscal Year 2014, earlier than the Pretreatment and High Level Waste facilities. A phased start-up approach is being evaluated for LAW facility and the Analytical Lab. The lessons learned from the phased start-up and commissioning of LAW facility and the Analytical Lab would be incorporated into the start-up of Pretreatment and High Level Waste facilities. There are no plans to proceed with operations of the LAW facility and the Analytical Lab prior to commissioning and operation of the Pretreatment and High Level Waste facilities.

Question: What is the additional cost to commission these facilities early? How could commissioning these facilities early affect the overall treatment schedule for the WTP?

Assistant Secretary Triay: The Office of River Protection (ORP) has performed several evaluations associated with starting the LAW Facility, Balance of Facilities and the Analytical Laboratory in advance of the Pretreatment and High Level Waste facilities. Each of these studies utilized the expertise of Bechtel National, the Tank Operations Contractor and ORP personnel. Each of these studies generally concluded that dividing the Waste Treatment Plant construction site into two elements (an operational component and a construction component) imposed large inefficiencies on operations and construction. For example, additional treatment facilities would have to be installed in either the Tank Farms or the LAW facility to ensure that the feed from the Tank Farms are in compliance with the feed specifications for the LAW facility. Because construction of these facilities would have resulted in acceleration of the LAW facility operation by only a few years, acceleration of LAW operations was deemed not cost effective.

32. LOW-ACTIVITY WASTE VITRIFICATION FACILITY

Question: If the low-activity waste vitrification facility is completed and sits idle for several years, how would this affect its 40-year design life, including the useful life of the equipment, vessels, and instrumentation installed in the facility?

Assistant Secretary Triay: Completion of the Low Activity Waste (LAW) vitrification facility construction in 2015 will have no impact on the facility's 40 year design life. Tank waste will not be fed to the facility and the melters will not be operated until all the Waste Treatment and Immobilization Plant (WTP) facilities proceed with Cold Commissioning. Although WTP may be commissioned in a staggered strategy to transition from the less complex to more complex facilities to allow for incorporation of lessons-learned, it will be operated as a consolidated facility. Each of the facilities contains equipment that must be maintained/repaired/replaced during the facility life cycle. Equipment removal and maintenance access has been designed into the facility to allow these routine activities to occur. Obsolescence-prone items and high incremental maintenance items will not be installed in the construction sequence to minimize physical data and aging prior to facility operation.

33. LOW-ACTIVITY WASTE VITRIFICATION

Question: Could EM provide waste to the low-activity waste vitrification facility from selected tanks without pre-treating the waste? If so, how many tanks could provide waste, what facility modifications would be required, and how long would this supply of waste feed last?

Assistant Secretary Triay: EM has evaluated whether it would be feasible to provide some tank waste directly to the low-activity waste vitrification facility for treatment. A study to review this option was conducted in *Evaluation of Starting the Waste Treatment and Immobilization Plant (WTP) Low-Activity Waste (LAW) Facility First,* in 2007. This study noted that "[t]*here are no existing tank wastes which meet WTP feed specifications without pretreatment.*" The finding of that study remains valid today.

34. LOW-ACTIVITY WASTE VITRIFICATION

Question: If waste cannot be treated without pretreatment, would EM have to build a temporary pretreatment facility for the early operation of the low-activity waste vitrification facility? If so, how much would such a facility cost?

Assistant Secretary Triay: If the Office of Environmental Management (EM) were to commence early operation of the Low Activity Waste (LAW) vitrification facility a temporary pretreatment facility would be necessary; however, EM has no plans for a temporary pretreatment facility. EM has reviewed options for early operation of the LAW Facility, and none have been found to be cost effective.

35. HANFORD GROUNDWATER/RIVER PROTECTION

Question: In the past, concerns have been raised about the effectiveness of using pump-and-treat technology to treat groundwater contamination at the Hanford site. For example, in 2006, the Government Accountability Office (GAO) reported that a pump-and-treat system used to remove strontium-90 from the groundwater at the site was largely ineffective. In its fiscal year 2007 appropriation, the Office of Environmental Management (EM) received $10 million to develop alternative technologies to treat the contaminated groundwater and prevent it from entering the Columbia River, which flows through the site. Recently, EM allocated Recovery Act funds to build a new pump-and-treat system at the Hanford site. What has been done to improve the pump-and-treat technologies?

Assistant Secretary Triay: Pump-and-treat has proven to be effective for addressing groundwater plumes with controlled contaminant sources in environments that exhibit poor binding of contaminants to aquifer materials. For example, pump-and-treat is a viable and demonstrably successful technology for performing chromium remediation in the Hanford river corridor.

American Recovery and Reinvestment Act (Recovery Act) funds are being used to implement treatment systems designed to remediate chromium plumes to meet Hanford Federal Facility Agreement and Consent Order milestones and target dates. At the time of the GAO audit, chromium treatment systems were designed to contain the plumes as required by records of decision for interim action. The new designs will be more effective and efficient in meeting groundwater restoration and environmental protection and remediation goals described in the milestones and in future records of decision. Enhanced effectiveness and efficiency are achieved by using improved treatment resins that increase contaminant uptake and removal and decrease the frequency of resin regeneration.

Recovery Act funds are also being used to build a large pump-and-treat system to address contaminants in the Hanford 200 West Area. The system is designed for large-scale mass removal of carbon tetrachloride, the key contaminant. This remedial approach has been proven effective when combined with source removal through soil vapor extraction.

Question: Is EM deploying the older technologies the GAO expressed concern over or different technologies with Recovery Act funds?

Assistant Secretary Triay: Recovery Act funds are not being used to deploy failing technologies as identified in the 2006 GAO audit. Recovery Act funds are being used to construct groundwater treatment systems such as the new permeable reactive barrier technology being tested at the 100-N Area as a replacement for pump-and-treat technology.

Question: If the older technologies, what have you done to resolve concerns with the technologies?

Assistant Secretary Triay: Actions have been taken to address specific concerns identified in the 2006 GAO report. First, the ineffective pump-and-treat system at 100-N has been placed in cold-standby status and a new permeable reactive barrier is being tested. Three hundred feet of the apatite mineral-based barrier has been emplaced. It is performing according to designed performance objectives, reducing strontium-90 concentrations by ninety percent. Second, phosphate-based uranium sequestration technologies are currently being tested at the 300 Area as a replacement for natural attenuation, which was not meeting compliance objectives. Initial tests demonstrated that uranium can be precipitated out of groundwater. Additional tests will begin in the coming weeks to determine whether the source of uranium contamination in groundwater can be stabilized in the soil. Third, breakthrough of chromium contamination at the 100-D Area In Situ Redox Manipulation barrier is being addressed. Supplemental iron has been injected into the barrier to enhance its ability to prevent chromium migration. The results will be used in remediation decision making for that area.

Question: The fiscal year 2010 request for soil and water remediation is approximately $130 million, $75 million below fiscal year 2010 enacted. The explanation of this decrease is due to the completion of pump-and-treat work and deferment of work into future years. Please provide further explanation as groundwater remediation has historically been considered a high-priority risk reduction activity.

Assistant Secretary Triay: Groundwater remediation continues to be a high-priority risk reduction activity. As the project description notes, some of the groundwater activities will be funded by the Recovery Act. Since February, EM has allocated an additional $90 million of Recovery Act resources for soil and groundwater cleanup activities. As the Hanford site continues to perform Recovery Act work on cost and schedule, EM plans to increase funding for groundwater activities from efficiencies and unused management reserve and DOE contingency.

36. SAVANNAH RIVER SITE OVERALL FUNDING LEVEL

Question: The total Savannah River Site fiscal year 2011 budget request is $1.2 billion, nearly the same as the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates missing the following milestone due to project management challenges: Start-up of Salt Waste Processing Facility Operations by September 30, 2011. The schedule for meeting this commitment is not recoverable at any funding level and EM anticipates renegotiating it.

Question: At this funding level are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting all other FY 2011 regulatory cleanup milestones with the requested budget plus current ARRA funds, and therefore, we do not expect any fines and penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates renegotiating the SWPF startup commitment and meeting all other FY 2011 regulatory cleanup milestones with the requested budget plus current ARRA funds, and therefore, we do not expect any violations.

37. SAVANNAH RIVER PENSION CHALLENGE

Question: Most of the Department's major contractors sponsor defined benefit pension plans which promise to pay specified benefits to their employees, such as a percentage of the final average pay for each year of service. The Department's allowable costs under these contracts include reimbursement of annual contractor contributions to these pension plans. Total funded status of the Department's contractor pension plans declined by $10.7 billion in fiscal year 2009 (from a negative net funded status of $2.0 billion in fiscal year 2008 to a negative net funded status of $12.7 billion in fiscal year2009). Given this greatly increased funding shortfall, what process has the Department established to estimate and assign pension contribution at the Savannah River Site and others?

Assistant Secretary Triay: The Department has taken a hard look at the cost reimbursement contractor's defined benefit pension plans at all our sites. We have done so, although that is an area of indirect costs we expect the contractors to manage according to their Disclosure Statement, as required by Cost Accounting Standards, without our input. The Department is committed to supporting the contractors' funding of pension plans to achieve funding in conformance with their statutory obligations, inclusive of Pension Protection Act (PPA).

Early this year, the Department implemented an enhanced annual contractor defined benefit (DB) pension plan management review process with the specific objective of improving insight into the predictability of costs and of containing current and future costs to the Department, as highlighted by the type of shortfall you referenced. Each cost reimbursement Contractor who sponsors a pension plan is now required to provide annual DB pension plan data and information to DOE for review in January of each year. As a result, DOE and the contractor can engage in fact-finding and discussions concerning the contractor's pension cost management approach prior to the contractor's actuarial certification of the DB plan, as required under the PPA. This is planned carefully to respect the contractor's fiduciary responsibility in management of the plan. For each contractor DB pension plan beginning with pension plan year 2010, contractors are to provide to the cognizant Contracting Officer a Pension Management Plan including discussions of key actuarial valuations and methods, estimated contributions, and a detailed assessment of the effectiveness of the Plan investment objectives and asset allocations. The contractor's Pension Management Plan will be updated annually and submitted to the Contracting Officer. Contractor representatives will meet with the Contracting Officer and other DOE representatives to discuss the Contractor's proposed Pension Management Plan revisions. We anticipate discussing any differences between the prior fiscal year's projected DB pension contributions for future fiscal years and the most recent projected pension contributions for future years and the rationale for any such discrepancies.

Question: What impact has this pension funding shortfall had on program execution at the Savannah River Site and others?

Assistant Secretary Triay: To maximize the program execution at Savannah River and other sites, the EM, in conformance with Departmental policy, is reimbursing the contractor's defined benefit pension plans at 60% of the minimum funding level. This frees up funds that can be used to advance cleanup at our sites and maintain and create jobs currently, as we support recovery of our national economic environment, but recognize that doing so may increase the longer term pension funding to our cost reimbursement contractors with a corresponding impact on DOE programs.

38. H-CANYON

Question: The Subcommittee is concerned that the costs of maintaining H-Canyon may not be worth the benefit of processing additional material. What are the life-cycle costs for operating H-Canyon to process additional nuclear material?

Assistant Secretary Triay: As identified in the H-Canyon lifecycle cost report that the Department submitted to Congress last year, the lifecycle cost estimate for processing approximately 21 metric tons of surplus highly enriched uranium (including about 13.5 metric tons of highly enriched uranium contained in aluminum-clad spent nuclear fuel (SNF)) and some surplus plutonium is in the range of $5.6 billion to $5.9 billion in FY 2009 dollars. This cost range consists of the costs to operate both H-Canyon and the L-Basin SNF storage facility and subsequent deactivation of those facilities, the incremental cost to operate the Liquid Waste System to disposition wastes resulting from H-Canyon operations, the cost to consolidate aluminum-clad SNF at the Savannah River Site and non-aluminum-clad SNF at Idaho, and the estimated cost for eventual decommissioning of H-Canyon.

39. F-CANYON

Question: The Office of Environmental Management (EM) has completed the de-inventory and deactivation of F-Area facilities, including F-Canyon and FB-Line. Are any future missions being considered for F-Area facilities?

Assistant Secretary Triay: EM previously completed the de-inventory and deactivation of the F-Canyon and FB-Line facilities; however, F-Canyon is currently being used to support legacy transuranic (TRU) waste remediation activities as part of the American Recovery and Reinvestment Act program. It is expected that TRU waste remediation activities will be completed in F-Canyon prior to Fiscal Year (FY) 2013. At that time, the F-Canyon and FB-Line facilities will be maintained in a safe configuration until decontamination and decommissioning (D&D) begins.

Question: If not, when does EM's plan to begin decontamination and decommissioning activities in F-Area facilities?

Assistant Secretary Triay: D&D of F-Area (including F Canyon and FB Line) is currently scheduled to begin in FY 2019.

40. SAVANNAH RIVER SITE LIQUID WASTE OPERATIONS

Question: The Office of Environmental Management (EM) announced a request for proposals for the Savannah River Site liquid waste operations at the end of 2007 and signed a contract at the end of 2008, marking the first time that tank closure would not be the responsibility of the Savannah River Site management and operating contractor. What were the reasons for this change?

Assistant Secretary Triay: The liquid waste system at Savannah River Site (SRS) poses the largest environmental risk of any program at SRS. While good progress had been made at SRS in addressing this risk and pursuing our goals for the liquid waste program, much work remains to be done and timelines for mission completion were not accelerating as desired. This led EM to pursue a contract award to bring in a management team and an organization structure focused solely on acceleration of the liquid waste mission. This strategy led to a contract award to Savannah River Remediation, LLC. The Contractor is using a systems engineering approach for improving waste processing rates and accelerating tank closures with a goal of closing all 22 remaining noncompliant tanks at SRS within eight years.

41. WASTE TANK CLOSURE PROGRAM CLASSIFICATION CHANGE

Question: In 2009, EM changed the classification of the liquid radioactive waste tank closure program from a project to an operation. As a result, the program no longer falls under the jurisdiction of DOE Order 413.3A, which establishes a process for managing projects with a total cost equal to or greater than $20 million. What guidance will EM use to manage the tank closure program, for which EM estimated it would make $550 million a year available in the 2007 Request for Proposals?

Assistant Secretary Triay: The Office of Environmental Management (EM) has recently established the protocol for managing and reporting progress for Operations Programs. Although the operations programs will no longer be subject to DOE Order 413.3A requirements, the project management principles contained in the Order will apply in a tailored manner. EM expects the field sites to maintain control of the activities, utilize processes and procedures that are currently in place, manage operation work scope effectively and efficiently, and meet contract, cost, and performance requirements.

42. CONTRACT COSTS

Question:The Department recently established its Office of Cost Analysis (OCA) to improve cost-estimating capabilities and better ensure that its project cost estimates are reliable by providing a new independent cost-estimating function for the Department. Was OCA involved in estimating costs included in the liquid waste operations contract? If not, what steps did EM take to ensure that contract costs were accurate and reliable?

Assistant Secretary Triay: No, OCA did not participate in estimating the cost for the liquid waste operations contract.

An Independent Government Cost Estimate (IGCE) was completed by the Savannah River Operations Office in 2007. The IGCE was developed for DOE-SR by Project, Time & Cost, Inc. (PT&C) through an existing contractual arrangement between DOE and the U.S. Army Corps of Engineers. PT&C has significant experience in preparing government estimates including the development of similar baselines and estimates for DOE's Office of River Protection.

EM assigned the lead Cost and Pricing Specialist to the Source Evaluation Board (SEB) for its review of the liquid waste bids. The SEB utilized the IGCE in reviewing the offerors' proposed cost for the liquid waste contract to determine those cost estimates to be reasonable and realistic. This determination was subsequently reviewed by EM's Acquisition and Contract Management Team (EM-80) and DOE's Office of Procurement and Assistance Management (MA-60).

43. DEFENSE WASTE PROCESSING FACILITY

Question: The new Savannah River Site liquid waste operations contract calls for the production of an average of 400 high-level waste canisters per year at Defense Waste Processing Facility (DWPF) in order to empty 20 non-compliant radioactive waste tanks by 2017. What has been DWPF's track record in reaching this production level in the past and is the facility on track to achieve this production level and meet the Federal Facilities Agreement requirement to close 22 non-compliant tanks by 2022?

Assistant Secretary Triay: DWPF has produced an average of 214 high-level waste canisters per year for the last 12 years. As part of its winning proposal, Savannah River Remediation, LLC (liquid waste operations contractor) identified a suite of equipment modifications that could increase DWPF production to a rate up to 400 canisters per year. Design and fabrication of these modifications are in progress. The facility is on track to achieve the production levels outlined in the contract and to support tank closures.

Question: What is the status of the Office of Environmental Management's efforts to increase DWPF throughput rates in order to achieve the canister production rate stipulated in the new liquid waste contract?

Assistant Secretary Triay: Design and fabrication of the equipment modifications required to increase DWPF throughput are in progress. The first facility modifications are scheduled for this fall and would increase DWPF throughput from an average of 214 canisters per year to a rate of 325 canisters per year. The second set of improvements, scheduled for the fall of 2011, would increase the processing rate to 400 canisters per year.

44. SALT WASTE PROCESS FACILITY AND COST ESTIMATES

Question: The Government Accountability Office (GAO) recently reported that cost estimate for the Salt Waste Processing Facility (SWPF) did not fully achieve the characteristics of high-quality estimates as identified by the professional cost-estimating community and documented in GAO's cost guide. What steps will the Office of Environmental Management (EM) take to ensure high-quality cost estimates for future SWPF operations and other EM projects?

Assistant Secretary Triay: EM is taking the following steps to assure high-quality costs. First, as the SWPF line item construction matures, the first year of operations will be re-estimated based on the forecasted operational requirements for the SWPF at that time. Once the facility is fully operational, the Operations and Maintenance of the facility will be awarded as a separate contract. An Independent Government Cost Estimate will be prepared to support that contract acquisition, followed by the development of a revised life-cycle baseline.

During FY 2010, EM's Office of Cost Estimating & Analysis plans to issue and EM-specific Cost Estimate Development Practice, Basis of Estimate Procedure, Cost Estimate Review Procedure, and EM Cost Estimating Guide. These standard practices will enable EM to standardize cost estimating practices across the EM complex. This guidance, combined with policies and procedures developed last year are laying a solid foundation to improve EM's cost estimating practices.

45. THE ACTINIDE REMOVAL PROCESS/MODULAR CAUSTIC SIDE SOLVENT EXTRACTION UNIT (ARP/MCU)

Question: The Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit (ARP/MCU) process that Savannah River is using as an interim salt waste processing facility uses similar technology as the full-scale Salt Waste Processing Facility. ARP/MCU has not achieved expected rates of throughput, however. What actions has EM taken to ensure that SWPF will be able to meet projected throughput rates?

Assistant Secretary Triay: Operation of ARP/MCU has already provided several practical lessons for application to future SWPF operations. First, EM documented chemistry adjustments to waste feed batches in order to reduce the risk of precipitation of waste constituents within the process. Second, the time required to qualify a feed batch is gradually being trimmed down with each feed batch prepared for ARP/MCU. Third, more deliberate planning and execution is required to minimize radiological exposure to personnel making repairs because ARP/MCU does not have the robust shielding or equipment redundancy of SWPF. This experience will make repairs in SWPF easier. Fourth, ARP/MCU is gradually acquiring the operating experience to increase its processing rate, and set weekly records in early November and early December 2009. Lastly, in order to ensure that SWPF has the latest information on ARP/MCU operating experience, technology exchanges between SWPF and ARP/MCU personnel are held at least bi-monthly.

Question: What would be the impact should the SWPF not be able to meet its projected throughput rates?

Assistant Secretary Triay: The salt processing mission is dependent on SWPF throughput. Failure to meet projected throughput rates would put the Site Treatment Plan at risk. However, concepts have been proposed and are under evaluation to augment SWPF salt processing which not only provide risk reduction to SWPF throughput but may even allow early completion of the salt processing mission.

46. SWPF START-UP DATE

Question: In 2009, the SWPF start-up date was further delayed from 2012 to 2013; the original start-up date was 2009. What affect will these delays have on the Department's ability to meet the tank closure milestones identified in the Federal Facilities Agreement? What steps will EM take to ensure tank closure milestones are met should SWPF start-up be delayed beyond 2013?

Assistant Secretary Triay: The delay in SWPF startup to 2013 will not adversely affect tank closure milestones in the Savannah River Site (SRS) Federal Facility Agreement. EM is evaluating running the SRS Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit for a longer duration than originally planned. In addition, we are developing supplemental SRS salt waste treatment capability using small column ion exchange technology that will accelerate completion of liquid waste treatment at SRS. Both of these steps will help mitigate delays in SWPF startup.

47. TANK SPACE

Question: Current tank cleaning and waste processing techniques require the addition of water to the tanks, which are nearly full. What is the status of the Office of Environmental Management's (EM) operations to create enough tank space to accommodate the tank closure schedule? What assurances can EM provide that tank closure operations will not be halted by a lack of tank space?

Assistant Secretary Triay: The EM program has a robust planning process that is used to manage tank space at Savannah River. The combined tank space gain from evaporator operations and salt waste processing with Actinide Removal Process/Modular Caustic Side Solvent Extraction Unit accommodates influents from H-Canyon operations and Defense Waste Processing Facility during the interim period before Salt Waste Processing Facility (SWPF) startup. Once SWPF initiates processing, SWPF operations combined with evaporator operations provides the requisite space recovery to support tank cleaning and other influents. Additionally, Savannah River Remediation, LLC will deploy Enhanced Chemical Cleaning to significantly reduce the quantity of water added during tank cleaning.

48. TANK SPACE AND H-CANYON

Question: What will be the impact of the proposed enriched uranium disposition project planned for H-Canyon on available tank space?

Assistant Secretary Triay: The impacts to the Savannah River Site (SRS) Liquid Waste System resulting from operating H-Canyon have been thoroughly evaluated. The January 2010 *Liquid Waste System Plan*, Revision 15, has accounted for the projected liquid radioactive waste that would be generated from processing up to approximately 19,500 aluminum-clad spent nuclear fuel assemblies containing about 13.5 metric tons of highly enriched uranium. As identified in the H-Canyon lifecycle cost report that the Department submitted to Congress last year, H-canyon processing would result in a total of 2.9 million gallons of high-level waste (HLW), or an additional eight percent of the current HLW inventory of 37.7 million gallons, and 1.7 million gallons of low-level waste (LLW), or 1.5 percent of the total LLW to be processed at the Saltstone Facility, that would need to be disposed through the liquid waste system.

Question: Won't the large amount of liquid radioactive waste generated by H Canyon operations exacerbate already strained tank capacity?

Assistant Secretary Triay: H-Canyon operation contributes a small amount of waste to the liquid waste system relative to other sources of waste, such as Defense Waste Processing Facility recycle. The January 2010 *Liquid Waste System Plan*, Revision 15, operation of H-Canyon to process aluminum-clad used nuclear fuel would generate a nominal 0.3 million gallons per year into the tank farms, which is less than 7 percent of the nominal 4.4 million gallons of liquid radioactive waste that is generated each year from sources other than operation of H-Canyon. Interim salt processing activities and the operation of the Salt Waste Processing Facility will ultimately resolve tank space issues. In the meantime, the salt waste is being processed in the Actinide Removal Project and the Modular Caustic Side Solvent Extraction Unit to assure sufficient tank space remains available.

49. TANK CLOSURE

Question: The current Savannah River Site liquid waste operations contract calls for the use of the chemical cleaning process that will, among other things, accelerate tank cleaning without adding significantly to the volume of waste contained in the tanks. This process plays an integral role in meeting accelerated tank closure deadlines. Recent budget decisions by the Department, however, have resulted in delays to the implementation of this process. What steps is the Office of Environmental Management (EM) taking to ensure that enhanced chemical cleaning is not delayed further as a result of decisions about the fiscal year 2011 budget?

Assistant Secretary Triay: Although funding uncertainties in late Fiscal Year (FY) 2009 and early FY 2010 have resulted in delays to the implementation of the enhanced chemical cleaning (ECC) process, ECC remains an integral technology in meeting accelerated tank closure deadlines. The program to implement ECC is continuing with high priority. Recovery Act funding is being used to supplement the program in FY10. The federal project director has established an Integrated Project Team to provide near term focus on conceptual design and testing tasks on the critical path. In addition, the Liquid Waste contractor is currently incorporating development of the ECC process into its contract performance baseline.

50. TANK CLOSURE

Question: EM has succeeded in closing two tanks in the 17 years since entering into the Federal Facilities Agreement. What is the current status of the remaining 47 tanks?

Assistant Secretary Triay: There are 49 tanks remaining at the Savannah River Site. There are 24 old-style tanks which are required to be closed by the Federal Facility Agreement (FFA). Seventeen of the 24 old-style tanks are undergoing or have completed Bulk Waste Removal and will be entering the Tank Cleaning stage of the closure process. Of the 17, two tanks have been closed (Tanks 17 and 20), and five more are scheduled for FFA closure in FY 2011 and 2012. The 27 new-style tanks also contain waste. Closure of these new-style tanks will begin following closure of all the old-style tanks.

Question: In what order is EM selecting which tanks to clean, and why?

Assistant Secretary Triay: The old-style tanks are being cleaned and closed first because these tanks present a higher environmental risk from potential leaks due to the tank design. For the new-style tanks, salt and sludge waste removals are scheduled to create the best blend of feeds to DWPF and SWPF. If multiple tanks are available for blending, the first preference is given to closing tanks in F-Tank Farm to enable the earliest possible footprint reduction.

Question: Please submit for the record EM's plan for closing the remaining tanks, including tank number, year to be closed, and funding necessary.

Assistant Secretary Triay: The table below shows the 51 tanks by tank number and the closure dates for the remaining 49 tanks.

Tank	Grouting Complete	Tank	Grouting Complete	Tank	Grouting Complete	Tank	Grouting Complete
1	Jun 2017	13	Jun 2017	26	Feb 2028	39	Feb 2026
2	Dec 2017	14	Mar 2015	27	Nov 2027	40	Sep 2031
3	Jun 2018	15	Sep 2015	28	Dec 2020	41	Sep 2030
4	Jun 2015	16	Nov 2012	29	Aug 2027	42	Mar 2030
5	Aug 2012	17	CLOSED	30	Feb 2028	43	Apr 2029
6	Oct 2012	18	Jun 2011	31	Aug 2025	44	Aug 2022
7	Jan 2014	19	Jun 2011	32	Jun 2030	45	Feb 2025
8	Mar 2015	20	CLOSED	33	Aug 2028	46	Aug 2026
9	Sep 2016	21	Jun 2017	34	Jan 2029	47	Feb 2027
10	Mar 2016	22	Dec 2015	35	Aug 2026	48	Oct 2031
11	Mar 2015	23	Sep 2016	36	Feb 2027	49	Sep 2031
12	Dec 2014	24	Dec 2016	37	Dec 2030	50	Dec 2029
		25	Mar 2027	38	Dec 2029	51	Jan 2032

The lifecycle cost estimate to complete the liquid waste mission is between $16 billion and $24.5 billion. Closing of all the tanks requires the operation of all liquid waste facilities including Defense Waste Processing Facility and Salt Waste Processing Facility.

51. PLUTONIUM PREPARATION PLANT

Question: The Plutonium Preparation Plant has been combined with Pit Disassembly and Conversion Plant into a single project. This single project is funded in the National Nuclear Security Administration's (NNSA) nonproliferation account. What are the current mechanisms for coordinating the EM mission requirements with the NNSA?

Assistant Secretary Triay: DOE is examining the combination of NNSA's Pit Disassembly and Conversion Facility (PDCF) and EM's Plutonium Preparation (PuP) projects into a single project to be located in K-Area at Savannah River Site and managed by NNSA. The NNSA project team, in coordination with EM, is developing a Critical Decision (CD) 1 package that will evaluate:

1) the stand alone NNSA PDCF project and EM PuP project; and
2) the combined project as a second alternative.

The project execution plan being developed for CD 1 by the project team will assure the coordination and integration of the EM mission requirements with NNSA.

Question: Since no funding is requested in the EM budget for this project, how are you funding EM's involvement in consolidation planning and analysis?

Assistant Secretary Triay: EM was appropriated $15.3 million for PuP in Fiscal Year (FY) 2010. EM plans to spend approximately $9 million of operating funds in FY 2010 to complete limited conceptual design of the PuP stabilization and packaging glovebox and $6.3 million of project engineering and design funds in FY 2011 to initiate preliminary design of this glovebox. This funding will support a portion of the EM scope of the proposed combined project.

52. WASTE ISOLATION PILOT PLANT OVERALL FUNDING LEVEL

Question: The Waste Isolation Pilot Plant (WIPP) fiscal year 2011 budget request is $220 million – a decrease of $10 million from the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Waste Isolation Pilot Plant (WIPP) does not have any compliance milestones.

Question: Since it is a disposal facility, are there other sites that will miss milestones due to the level of funding proposed for WIPP?

Assistant Secretary Triay: No. There will not be any missed milestones due to the decrease of the level of funding for WIPP. The current funding will support a steady-state shipping rate in Fiscal Year (FY) 2011.

Question: At this funding level are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

53. CARBON TETRACHLORIDE IN AIR

Question: While the current levels of Carbon Tetracholoride in the air in the Waste Isolation Pilot Plant are below worker health safety levels, the problem could grow. What is the source of the carbon tetracholoride? [It's suspected to be drums of Rocky Flats waste. Additional drums are awaiting shipment from Idaho National Laboratory]

Assistant Secretary Triay: Carbon tetrachloride is an organic compound formerly used as a fire suppressant in fire extinguishers and as a cleaning agent. It was used at some DOE facilities as a solvent in nuclear weapons production. Carbon tetrachloride is a constituent in a solidified organic sludge waste stream that was generated at the Rocky Flats Environmental Technology Site. These solidified sludge drums are now stored at the Idaho National Laboratory (INL). Several thousand drums of this waste have been disposed in Panel 3, 4, and 5 at WIPP, with the majority located in Panel 5. There are several thousand additional drums of this waste now stored at the INL remaining to be shipped to WIPP for disposal.

Question: What is being done about the growing amounts?

Assistant Secretary Triay: WIPP has more than 10 years of monitoring data on volatile organic compound levels, including carbon tetrachloride, in the underground which demonstrate that workers have never been exposed to unsafe concentrations. The design of the underground repository ventilation system is such that the workers are located upstream from the repository air possibly containing carbon tetrachloride, and entry to areas where carbon tetrachloride emissions may be present is controlled. In addition, several actions have been taken at WIPP to address carbon tetrachloride in the repository air. Ventilation barriers located in closed Panels 3 and 4 have been sealed more thoroughly, and bulkheads have been installed in the active Panel 5 between filled disposal rooms and active disposal rooms. A granulated active charcoal system has been installed to reduce emissions from Panel 4. If found to be effective, a similar granulated active charcoal system may be used at Panel 5 after closure. Waste shipments from Idaho that may contain carbon tetrachloride have been suspended and measures for reducing emission levels from containers to be shipped in the future are being evaluated. One measure specifically being considered is shipping containers of this waste in overpack containers. Once received at WIPP, all but one of the vented filter ports would be plugged to restrict emissions.

54. VOLUME OF TRANSURANIC WASTE

Question: How much Transuranic (TRU) waste to date has been disposed at the Waste Isolation Pilot Plant (WIPP) in New Mexico? Given the statutory limit, will the capacity of WIPP be adequate for disposing of the Department's current inventory of stored TRU waste, as well as additional TRU waste generated over the next 30 years?

Assistant Secretary Triay: As of March 29, 2010, 66,124 cubic meters of contact-handled waste and 166 cubic meters of remote-handled waste have been emplaced in the underground. Per the latest formal reporting, the anticipated volumes plus the emplaced volumes are less than the authorized volume in the WIPP Land Withdrawal Act and therefore the capacity of the repository is adequate.

55. REMOTE-HANDLED TRANSURANIC WASTE

Question: To maximize the amount of waste that can be stored in the Waste Isolation Pilot Plant, the Office of Environmental Management (EM) generally plans to store first the more dangerous remote-handled waste and then the contact-handled waste. There has been some indication, however, that the portion of WIPP intended for remote-handled transuranic (TRU) has been utilized for contact-handled TRU. This is potentially reducing WIPP's available capacity for the remote-handled waste. Is this accurate?

Assistant Secretary Triay: Remote-handled transuranic (RH-TRU) waste is placed in boreholes in the walls of the rooms where contact-handled transuranic (CH-TRU) waste is to be emplaced. Regulatory approvals to dispose of RH-TRU waste were not granted until 2007 yet CH-TRU waste disposal had begun in 1999. Thus, a portion of the WIPP repository used for CH-TRU disposal was no longer available for RH-TRU waste disposal. This reduced WIPP's RH-TRU waste capacity based on the original design and plan to place RH-TRU waste in the boreholes in the walls. However, EM is pursuing alternative processes, such as lead-lined shielded container stacked on the floor of a room, to compensate for some of the lost RH-TRU waste disposal capacity.

Question: If so, how much capacity remains for remote-handled TRU?

Assistant Secretary Triay: The WIPP Land Withdrawal Act specifies the total statutory capacity for WIPP at 175,675 cubic meters, although an agreement between DOE and the State of New Mexico limits the volume of RH-TRU waste that can be emplaced at 7,080 cubic meters. As of March 29, 2010, a total of 166 cubic meters of RH-TRU waste has been emplaced, leaving 6,914 cubic meters of permitted RH-TRU waste capacity remaining.

Question: What is EM's strategy to ensure it has adequate capacity for this waste?

Assistant Secretary Triay: EM is assuring adequate capacity for RH-TRU waste by accelerating RH-TRU waste shipments and by pursuing packaging alternatives. Through the American Recovery and Reinvestment Act, the Department is accelerating RH-TRU processing activities to support an optimized RH-TRU shipment rate of five per week. In addition, EM is pursuing use of a lead-lined shielded container which, when utilized, will enable RH-TRU waste to be disposed like CH-TRU waste on the floor of a disposal room, rather than in boreholes in the room walls. EM expects to receive the regulatory approvals necessary to enable use of the gamma-shielded container in 2011.

Question: What is DOE's current estimated inventory of remote-handled TRU?

Assistant Secretary Triay: The 2009 Annual TRU Inventory Report indicated an anticipated volume of RH waste of 4,550 cubic meters.

56. SAFETY RISKS OF TRANSURANIC WASTE

Question: The Department's sites that contain Transuranic (TRU) waste intended for disposal at Waste Isolation Pilot Plant (WIPP) must store the waste on site, pending preparation and eventual shipment to the repository. Interim storage of TRU could pose safety risks for sites, however. For example, the State of New Mexico expressed concern that the Cerro Grande fire of 2000 had posed a threat to the site's above-ground storage facility for TRU intended for WIPP. How are disposal schedules for sites established and priorities for disposal set?

Assistant Secretary Triay: Disposal schedules and shipping priorities are established between the sites, the Carlsbad Field Office, and DOE Headquarters. They are based on several balancing criteria including risk, safety, compliance, resources, contracted plans, and the amount of transuranic waste a generator site has ready to ship to WIPP. For example, priorities are determined, in part, by regulatory requirements such as the *Idaho Settlement Agreement* and the Consent Order at the Los Alamos National Laboratory (LANL). The schedules are maintained under configuration control and progress is measured continuously during the fiscal year.

Question: To what degree is each of the main TRU waste storage sites on schedule for disposing TRU waste at WIPP?

Assistant Secretary Triay: The main TRU waste storage sites, which are Idaho National Laboratory (INL), the Hanford Site, LANL, Oak Ridge National Laboratory, and Savannah River Site are actively shipping transuranic waste. Shipment goals are established annually in coordination with the generator sites, the Carlsbad Field Office, and Office of Environmental Management (EM) Headquarters to align with EM program goals. The backlog of packaged and approved TRU wastes has largely been shipped to WIPP and the TRU generator sites continue to process their TRU waste inventories to support the integrated shipping goals. The sites are generally performing in line with the goals although technical issues periodically arise which require the site-specific goals to be updated.

Question: EM's current TRU shipment rate, how likely is it that EM will complete disposal of all stored TRU waste by 2035, as planned? What are the primary challenges EM faces in achieving timely disposal of stored TRU waste at WIPP?

Assistant Secretary Triay: The current EM end state for WIPP is the cessation of disposal activities for legacy and newly generated transuranic waste from the DOE complex by 2030. Decommissioning of the surface facilities and permanent closure of the underground is scheduled to be completed in 2035. There remains some uncertainty about the time required to disposition the inventory of remote-handled TRU wastes stored at the Hanford Site. DOE continuously reviews the need for continued, long-term operations of WIPP, due to future generation of TRU waste by other DOE mission programs. EM has invested Recovery Act funds to accelerate completion of legacy TRU disposal, but the potential cost reductions that may be realized through the acceleration have not yet been incorporated into EM's life-cycle estimates. As necessary, the life-cycle plans for WIPP will be updated as part of DOE's strategic planning efforts.

The primary challenges EM faces in achieving timely disposal of legacy TRU wastes involve technical issues associated with retrieval and packaging of some RH-TRU volumes and size reduction and packaging of large box wastes. In general, much of the waste inventory remaining to be processed and shipped involves increased technical and regulatory challenges.

Question: In setting disposal schedules, how does EM factor in potential safety risks of interim storage and what is EM doing to investigate and minimize such risks?

Assistant Secretary Triay: Risk of TRU interim storage at the generator sites is one of the criteria considered in developing disposal schedules. For example, the Department is increasing shipment rates at LANL and prioritizing high-risk TRU waste for characterization and shipment in order to reduce risk to the public of TRU waste stored at Area G. In addition, the Department is maximizing use of existing LANL facilities and establishing additional capabilities for safe, efficient, and timely risk reduction.

Storage of legacy TRU waste at the various sites around the DOE complex is regulated under the Resource Conservation and Recovery Act (RCRA), and is permitted by the various state authorities. DOE considers this storage to be safe and environmentally protective as permitted. Most sites with legacy TRU waste storage are bound by agreements with states to disposition their TRU inventory under a negotiated schedule. These negotiated schedules are based on state and local authority concerns, which include risk, and are another criteria EM uses in setting disposal schedules.

57. IDAHO NATIONAL LABORATORY OVERALL FUNDING LEVEL

Question: The Idaho National Laboratory fiscal year 2011 budget request is $412 million, a decrease of $57 million from the fiscal year 2010 enacted level (includes Defense and Non-Defense Environmental Management funding). At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: EM anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, you are deferring the decontamination and decommissioning of buildings and slowing buried waste retrievals – are there any missed milestones as a result?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget. In fact, the decontamination and decommissioning mission at Idaho is being funded under the American Recovery and Reinvestment Act, which is allowing acceleration of current EM scope and new work to be accomplished.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No. EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines and penalties.

58. SODIUM-BONDED FUEL CLEAN-UP

Question: Last year, the fiscal year 2010 bill included $419.5 million specifically to address sodium-bonded fuel within the EM portfolio at Idaho National Laboratory (INL). What is the status of this project?

Assistant Secretary Triay: There is approximately 56 metric tons heavy metal (MTHM) of sodium-bonded spent nuclear fuel (SNF) at INL, of which 34.5 MTHM belongs to EM. The $19.5 million designated last year in the Fiscal Year (FY) 2010 conference report to "prepare and treat sodium-bonded SNF within the EM portfolio" will treat all of the EM-owned irradiated Fast Flux Test Facility (FFTF) sodium-bonded SNF, as well as the un-irradiated FFTF sodium-bonded fuel, all of which is located at the INL. Specifically, the following activities are proposed, which will complete the treatment of all EM-owned sodium-bonded fuel:

- commence facility preparations and disassembly for treatment of irradiated FFTF fuel stored at the Materials and Fuels Complex (MFC), and initiate electrochemical treatment campaign;
- acquire an FFTF un-irradiated sodium-bonded fuel treatment system; and
- complete in FY 2011, the electrochemical treatment campaign, begun in FY 2010

Disassembly of the irradiated fuel has been initiated. Treatment will begin in July 2010, and is anticipated to be completed by the end of FY 2011.

Question: Is this funding sufficient to address all sodium-bonded fuel at INL?

Assistant Secretary Triay: The $19.5 million is sufficient to address the EM-owned FFTF fuel (34.5 MTHM).

59. UNASSIGNED CLEAN-UP LEGACY

Question: The Committee also urged the Department last year to assign disposition responsibility for the remaining spent fuel, special nuclear material, and irradiated beryllium blocks. What is the status of this effort?

Assistant Secretary Triay: The Office of Environmental Management and Office of Nuclear Energy are working together to determine the appropriate disposition path for Idaho National Laboratory's excess facilities and materials which include spent nuclear fuel, special nuclear material, and irradiated beryllium that require disposition.

60. OFFICE OF NUCLEAR ENERGY LIABILITIES

Question: Could you provide a status on where clean-up work from the Office of Nuclear Energy ranks within the priorities for the Office of Environmental Management at Idaho?

Assistant Secretary Triay: The American Recovery and Reinvestment Act (Recovery Act) funds allowed the Office of Environmental Management (EM) to accept Office of Nuclear Energy (NE) workscope into the program for remediation as well as decontamination and decommissioning (D&D). Specifically, EM is performing D&D on 19 NE facilities with plans to complete this work by the end of FY 2011, with a small amount of work on the Experimental Breeder Reactor II completing in FY 2012. Recovery Act funds also allowed EM to accelerate processing and disposition of the NE Non-Sodium Remote Handled Transuranic Waste (RH-TRU). EM is processing the RH-TRU in the Idaho Nuclear Technology and Engineering Center Hot Cell. Shipments of this material to the Waste Isolation Pilot Plant have begun.

61. OAK RIDGE NATIONAL LABORATORY OVERALL FUNDING LEVEL

Question: The total Oak Ridge fiscal year 2011 budget request is $432 million, a decrease of $28 million from the fiscal year 2010 enacted level (includes Defense Environmental Management and uranium enrichment cleanup funding). At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The total Oak Ridge Fiscal Year (FY) 2011 budget request is actually a $28 million *increase* from the FY 2010 enacted level, and therefore, the Office of Environmental Management (EM) anticipates meeting its FY 2011 regulatory cleanup milestones; however, there are technical issues that may impact EM's ability to meet a few milestones.

Question: At this funding level, are you in compliance with the Federal Facilities Agreement and will you meet transuranic waste milestones?

Assistant Secretary Triay: Yes, the FY 2011 request maintains compliance with the Federal Facility Agreement and meets transuranic waste milestones although technical issues could impact a few milestones.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No fines or penalties are expected due to funding.

Question: How many violations and at what cost?

Assistant Secretary Triay: No fines or penalties are expected due to funding.

62. OAK RIDGE NATIONAL LABORATORY – BUILDING 3019

Question: Building 3019 at Oak Ridge has long been a focal point for your program. Your budget request contains $50 million to continue the design of the downblending facility, after it was found that the material isn't appropriate for WIPP, but will have to be sent to the Nevada Test Site instead. What are the practical implications of this difference? How will the waste have to be differently processed and/or packaged?

Assistant Secretary Triay: There are practical implications to the change in waste form. The change in the final waste form, which changes the disposal from the Waste Isolation Pilot Plant (WIPP) to Nevada Test Site (NTS) was also required to assure that it was not considered a mixed waste.

The change in waste form then required a significant design change. What was to be a high temperature thermal-treatment process resulting in a Uranium Oxide Powder will now be a low temperature drying process resulting in a Magnesium/Sodium Diuranate waste product. The processing risk is significantly reduced by changing the design to the low-temperature drying process, but the project also incurred an increase in the estimated shipping cost to dispose of the product at the NTS as a low-level waste (LLW).

Question: Even though the funding you're requesting is supposedly to get the facility to 90% design, you request the bulk of this funding in "Construction" rather than in "Planning, Evaluation and Design". Why?

Assistant Secretary Triay: This project has been budgeted as an operating expense funded project. Since this project is not a line item construction project, separate funding for Project Engineering and Design and construction funds do not exist. We expect the U-233 project design to be complete in early Fiscal Year (FY) 2011. If project design efforts continue into December 2010, it is estimated that, based on current design costs, $6.6 million of the FY 2011 funds will be needed to complete the design for DOE acceptance. The balance of funding in FY 2011 will be used for construction related activities and for surveillance and maintenance of the Nuclear Category 2 and Security Category 1 facility (Building 3019).

63. LOS ALAMOS LABORATORY OVERALL FUNDING LEVEL

Question: The total request for cleanup activities at Los Alamos National Laboratory is $197 million, the same as fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and, therefore, we do not expect any violations.

64. GROUNDWATER MONITORING

Question: In November 2009, Los Alamos National Laboratory received a fine from regulators for not providing sufficient groundwater monitoring. Have these issues been resolved?

Assistant Secretary Triay: The New Mexico Environment Department (NMED) issued fines for Materials Disposal Area (MDA) G, citing insufficient groundwater data necessary to defend selection of a final remedy. To address the insufficient groundwater data issue, Los Alamos installed seven additional wells, bringing the total to 17 around MDA G. The NMED has issued two letters demanding payment totaling $1,251,000 for 437 days of violation. These fines have been paid. NMED continues to review the groundwater data, and no additional fines have been issued.

65. NEVADA TEST SITE OVERALL FUNDING LEVEL

Question: The total request for cleanup activities at the Nevada Test Site is $66 million, the same as the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

66. WEST VALLY OVERALL FUNDING LEVEL

Question: The total West Valley site fiscal year 2011 budget request is $58 million, the same as the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

67. ENERGY TECHNOLOGY ENGINEERING CENTER OVERALL FUNDING LEVEL

Question: The Energy Technology and Engineering Center fiscal year 2011 budget request is $11 million, the same as the fiscal year 2010 enacted. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level, are there any fines or penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

68. LIFE-CYCLE COST INCREASE

Question: Even with the investment of $54 million of Recovery Act funding, it is our understanding that the life-cycle costs of the Energy Technology Engineering Center are increasing. What are the primary drivers for the significant life-cycle increase?

Assistant Secretary Triay: The primary drivers of the life-cycle increase are the congressionally mandated study to be performed by the Environmental Protection Agency as well as Fiscal Year 2010 and 2011 activities associated with site characterization. This is what the $54 million of Recovery Act funding has been applied towards.

69. COMPLETION DEADLINE

Question: The Department's budget request indicates clean-up work will be complete in the 2018 to 2025 timeframe. Yet, the existing Consent Order contains a 2017 deadline. What is the plan for addressing this potential conflict?

Assistant Secretary Triay: The existing Consent Order signed by the State of California, Boeing, National Aeronautics and Space Administration, and Department of Energy in August of 2007 reflects a projected cleanup date of 2017. Since that time, additional characterization work is being conducted. Once the work is completed, life-cycle cost and schedule will be adjusted, as appropriate.

70. BROOKHAVEN NATIONAL LABORATORY OVERALL FUNDING LEVEL

Question: The total request for cleanup activities at Brookhaven National Laboratory is $14 million, a decrease of $1 million from fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No. EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines and penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

Question: Is the fiscal year 2011 request sufficient to complete the cleanup work at this site?

Assistant Secretary Triay: The FY 2011 budget request positions BNL to complete its legacy cleanup work at the site.

71. STANFORD LINEAR ACCELERATOR CENTER OVERALL FUNDING LEVEL

Question: The total request for cleanup activities for the Stanford Linear Accelerator Center is $3.5 million, a decrease of $3.5 million from the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: The Office of Environmental Management (EM) anticipates meeting its Fiscal Year (FY) 2011 regulatory cleanup milestones with the requested budget.

Question: At this funding level are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No, EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any fines or penalties.

Question: How many violations and at what cost?

Assistant Secretary Triay: EM anticipates meeting its FY 2011 regulatory cleanup milestones with the requested budget, and therefore, we do not expect any violations.

72. MOAB OVERALL FUNDING LEVEL

Question: The total Moab site fiscal year 2011 budget request is $31 million, a $8 million decrease from the fiscal year 2010 enacted level. At this funding level, will you be missing any compliance milestones?

Assistant Secretary Triay: There are no compliance milestones at Moab.

Question: At this funding level, are there any fines and penalties associated with the missed milestones?

Assistant Secretary Triay: No because there are no compliance milestones at Moab.

Question: How many violations and at what cost?

Assistant Secretary Triay: None. There are no compliance milestones at Moab.

73. ARGONNE NATIONAL LAB OVERALL FUNDING LEVEL

Question: No funding is requested this year for cleanup at Argonne National Laboratory. While they received $29 million in fiscal year 2009 and $99 million from the Recovery Act, the total environmental liability there is estimated to be $750 million. What is the Department's plan to clean up this environmental legacy?

Assistant Secretary Triay: The Office of Environmental Management (EM) completed its legacy cleanup of Argonne National Laboratory (ANL) in Fiscal Year (FY) 2009. EM uses its base funding to address its legacy environmental cleanup liabilities first. Recovery Act funding has allowed EM to accept excess facilities and materials work scope at an earlier time period from other Departmental Program Offices, in this case the Office of Science. Additional facilities and materials that EM has agreed to accept from other Departmental Program Offices will be included in EM's work scope as completion of the program's legacy work permits. The Department remains committed to cleanup of the environmental liability at ANL.

74. UTILITY FEE

Question: Last year Congress soundly rejected the reinstitution of the $200 million utility fee to support the clean-up of the nation's gaseous diffusion plants. This proposal, which is an amendment to the Atomic Energy Act of 1954, should be submitted to the relevant authorizing Committees. Would you make your best case for why the Appropriations Committee should accept this approach to the problem?

Assistant Secretary Triay: The Uranium Enrichment Decontamination and Decommissioning (UED&D) Fund was established in the Energy Policy Act of 1992 to fund the cleanup of the three gaseous diffusion plants at Oak Ridge, Tennessee, Paducah, Kentucky, and Portsmouth, Ohio. In the *Uranium Enrichment Decontamination and Decommissioning Fund 2007 Report to Congress,* the Office of Environmental Management estimated that the UED&D Fund, with current contributions, will not be sufficient to meet its intended purpose; the Fund is projected to become insolvent in the Fiscal Year (FY) 2020 timeframe and have an estimated shortfall of $8 billion to $21 billion over the next 30 years.

Therefore, the Administration is proposing to reinstate the special assessment on domestic utilities starting in FY 2011, as well as additional Federal deposits into the Fund, over a 15-year period to address the shortfall in addressing the environmental liability at the three facilities. The Administration believes this proposal is necessary to forward fund the cleanup of these facilities and minimize the financial burden on taxpayers in the future. Decontamination, decommissioning, and remediation of enrichment facilities are the shared responsibility of both industry and the Federal Government. The proposal is estimated to address the currently expected shortfall.

The Administration agrees that this proposal falls within the jurisdiction of the relevant Authorizing Committees because it amends the Atomic Energy Act of 1954. If the Administration were to request that the Authorizers enact this proposal, the legislative language would seek to permit both the collection of the utility fee and the spending to support the cleanup of the nation's gaseous diffusion plants only subject to a trigger in subsequent appropriations action. The Administration would like both the collection and spending of the fee to ultimately be discretionary, similar to the 2011 Budget provisions, so that the budget authority scoring to the Appropriations Committee would be net of the collection and, therefore, emphasize the relationship between the fee and the cleanup. The reason the Administration proposed that the Appropriations Committee essentially enact both the authorization and the appropriation was for expediency. The Authorizers may not have an appropriate vehicle in which to move this legislation quickly and the Administration feels this fee needs to be enacted as soon as possible in order to help address the shortfall in the Fund.

75. UED&D FUND ADEQUACY

Question: What is your latest assessment of the adequacy of the Uranium Enrichment Decontamination and Decommissioning (UED&D) fund to cover the expenses of the clean-up at the nation's three uranium enrichment facilities—Paducah, Oak Ridge, and Portsmouth?

Assistant Secretary Triay: The last assessment on the adequacy of the Uranium Enrichment Decontamination and Decommissioning (UED&D) Fund was included in the *Uranium Enrichment Decontamination and Decommissioning Fund 2007 Report to Congress*, the Fifth Triennial Report. The Department conclude that the "UED&D Fund would need, in addition to the current balance of $4.1 billion, between $8 billion to $21 billion more to complete the Gaseous Diffusion Plant cleanup activities. Based on the above cost projections and accounting for the remaining contributions from the Government into the Fund, the "Base Case" shows a shortfall of approximately $11 billion." The sixth Triennial Report is currently under development and is due to Congress in October 2010.

Question: To what extent did the $390 million of Recovery Act funds for Paducah, Oak Ridge, and Portsmouth relieve pressure on the UED&D Fund?

Assistant Secretary Triay: The sixth Triennial Report, which is currently under development, will assess and report impacts of the American Recovery and Reinvestment Act funding on the UED&D Fund.

76. PORTSMOUTH LIFE-CYCLE SAVINGS AND JOBS

Question: The stated purpose of the $416 million requested for Portsmouth clean-up, over $180 million above fiscal year 2010, is to lower life-cycle costs. What are the savings from the acceleration plan and what is the completion date the request supports? How many jobs are supported by this request?

Assistant Secretary Triay: The Department's 2007 estimate for Portsmouth D&D estimated project costs of approximately $12 billion and a duration of 35 years. The accelerated scenario reduces the schedule duration by 19 years and reduces the project estimate by approximately $4.5 billion. The initial cost estimate was a rough approximation of costs that had between a -30% and a +50% cost range.

The $416 million of cleanup funds requested in Fiscal Year (FY) 2011 in the Uranium Enrichment Decontamination and Decommissioning Appropriation account, which does not include the Depleted Uranium Hexafluoride Conversion Project or safeguards and securities, is estimated to roughly correlate to approximately 2,000 jobs including subcontractors. The current work force for cleanup activities totals approximately 2,100 jobs, plus over 280 jobs to support uranium transfer work scope, over 160 to support the DUF6 project, and around 100 jobs to support protective forces. Current FY 2010 funding from appropriations, uranium transfer, and Recovery Act is comparable with the $416 million FY 2011 budget request.

77. FUNDING PORTSMOUTH CLEANUP

Question: The budget request includes a proposal, which Congress rejected last year, to reopen collections into the UED&D Fund. Additional revenues would be $200 million in fiscal year 2011. Perhaps coincidentally, the proposal for additional cleanup at Portsmouth is almost that same amount. It's an unfortunate game that the Administration seems to be playing…to introduce a proposal opposed by Congress in order to fund work which we all know should be done. Contrary to the plan you discussed with us last year, you now seem to be relying upon appropriated dollars to fund the cleanup instead of bartering of uranium. What prompted the Department to change its mind and go through the budget process rather than the barter transactions?

Assistant Secretary Triay: Since the yet to be awarded Portsmouth decontamination and decommissioning (D&D) contract will be funded for the most part from appropriations, it seemed consistent and more efficient to maintain a single funding source. Therefore, DOE sought appropriations to fund this work as part of the Fiscal Year (FY) 2011 budget request.

Question: If we do not fund your request for additional appropriated dollars for Portsmouth cleanup, do you have a back-up plan, such as reinstituting the uranium barter scheme?

Assistant Secretary Triay: The FY 2011 budget request at Portsmouth is significantly higher and reflects the Department's decision to request the funding needed to fully support accelerated D&D cleanup by fifteen to twenty years; this is also consistent with the Department's decision not to pursue uranium barter for cleanup services.

Question: How does the Department feel that the USEC barter arrangement has worked in funding additional cleanup at Portsmouth this year?

Assistant Secretary Triay: The uranium barter for accelerated USEC cleanup services has worked very smoothly to date. Two uranium barters for services have been successfully completed. Two more are scheduled in the final two quarters of FY 2010.

Question: Does the Department think that it has obtained the maximum value of the uranium bartered in this transaction?

Assistant Secretary Triay: Yes. The two transactions of 200 metric tons of uranium have been successfully completed, and DOE received fair market value at the time of sale.

78. TECHNOLOGY DEVELOPMENT STRATEGY

Question: The Department received $70 million for technology development in fiscal year 2010. Of this amount, $50 million was within the Office of River Protection. Congress directed that technology development should be focused on advancing solutions for the treatment of tank wastes not just at River Protection but complex-wide. How is the Department implementing this direction?

Assistant Secretary Triay: The Technology Development Program is focusing on developing transformational technologies to accelerate tank waste processing at both Hanford and the Savannah River Site (SRS), and is consistent with the 2009 National Academy of Science review of technology gaps. Areas of focus include: 1) the Waste Retrieval and Closure Technologies area develops technologies that allow tank waste retrieval to the maximum extent practical followed by chemical cleaning of the waste tank prior to closure; 2) the Alternative Waste Pretreatment area develops technologies for the pretreatment of Hanford and SRS liquid waste which will reduce the amount of waste processed and disposed of as high level waste (HLW); 3) the Advanced Unit Operations and Scaling will improve the modeling of Hanford and SRS tank waste mixing and processing and use lab and pilot scale data to verify and calibrate Computational Fluid Dynamic (CFD) or other types of numerical models; 4) the Improved Vitrification Capacity will develop alternative or improved melter designs for the Hanford Waste Treatment and Immobilization Plant (WTP) and the SRS Defense Waste Processing Facility (DWPF) that will enable operations at a higher throughput; and 5) increased Waste Loadings will develop improved glass formulations applicable to the Hanford WTP and the SRS DWPF that allow a higher waste loading and reduced life-cycle costs.

In summary, the EM technology development program is focusing its resources on the development of transformational technologies that will result in lower life-cycle costs and a shorter period of project execution.

79. HOW TECHNOLOGY DEVELOPMENT IS USED

Question: As one of the largest research agencies in the federal government, the Department spends billions of dollars each year on publicly funded research. How is the Department using its labs to develop technologies to address the complex task of cleaning up decades of accumulated nuclear and hazardous wastes?

Assistant Secretary Triay: The Office of Environmental Management (EM) directs the national laboratories, particularly those with close ties to EM sites such as the Savannah River National Laboratory (SRNL), the Pacific Northwest National Laboratory (PNNL), and the Oak Ridge National Laboratory (ORNL) to develop environmental cleanup technologies. The focus of our technology needs is primarily on Tank Waste. The reason EM is tasking the labs to do this is because we need transformational technologies to vastly reduce the life cycle cost and schedule of the tank waste system. Examples of technologies under development at the national laboratories include advanced glass formulations for increased radioactive waste loadings, an advanced cold crucible induction melter, and advanced chemical cleaning technologies for radioactive waste tanks.

Question: To what extent are the Department's sites using similar cleanup technologies, when possible, to help reduce development costs and increase cleanup efficiency?

Assistant Secretary Triay: The Technology Development and Deployment program seeks, wherever possible, to develop technologies that can be used at multiple sites. Current projects with multiple site application include:

- At-Tank/Near Tank Processing – use of at- or near-tank equipment will allow solids and radionuclides to be removed, accelerating processing rates and allowing early operations at both Hanford and Savannah River Site (SRS).
- Glass Optimization – improved glass formulations applicable to the Hanford WTP and the SRS DWPF will allow a higher waste loading and reduced life cycle costs.
- Alternative Treatment/Disposal Processes – A Fluidized Bed Steam Reforming (FBSR) technology is being developed that could be applied to waste streams at both Hanford and SRS.
- Mixing/Blending Systems Optimization – the use of lab and pilot scale data to verify and calibrate Computational Fluid Dynamic (CFD) or other types of numerical models will be used to improve the modeling of Hanford and SRS tank waste mixing and processing.
- Integrated Systems Analysis – To analyze alternatives to the current radioactive tank waste disposal technology, EM has developed a limited life-cycle model applicable to both the Hanford and SRS tank wastes. The next steps will be for site-specific process characteristics from current systems plans to be loaded into the model and validation runs to be completed.

Question: Why are the three sites with tank waste—Savannah River, Hanford, and Idaho—all using different technologies to treat their tank waste?

Assistant Secretary Triay: The three sites do use different technologies due to the composition of the radioactive tank waste. Hanford produced large volumes of about twenty different types of waste. SRS, built a decade after Hanford, produced two main types of waste using the plutonium-uranium extraction (PUREX) process and the H-modified PUREX process.

Another factor contributing to the use of different technologies are the waste tanks themselves. The Hanford and SRS tanks are constructed of carbon steel and cannot contain acid. Therefore the wastes were neutralized with caustic to produce an alkaline waste. The Idaho tanks were constructed with stainless steel and therefore the wastes were not neutralized with caustic. As the Idaho radioactive wastes were acidic, a different disposition approach, calcination was appropriate.

Question: How does the Department balance the need to develop innovative technologies to clean up waste and the ability to use technology which may take a bit longer, but has already been successfully used?

Assistant Secretary Triay: The EM Technology Development and Deployment program manages a carefully selected portfolio of projects designed to focus on high risk, high cost environmental risk reduction. Funding is focused on alternative technologies and technological advances that can provide transformational impacts that significantly reduce the lifecycle cost of the program and shorten the program time period of execution; or have the greatest potential for changing the dynamics of site cleanup.

80. 2008 EXCESS URANIUM MANAGEMENT PLAN

Question: In December 2008, in response to a recommendation from the Government Accountability Office. the Department issued an "Excess Uranium Inventory Management Plan" that was intended to "provide the general public and interested stakeholders more specific information and enhanced transparency with respect to the Department's preliminary plans for its excess uranium transactions." By and large, the domestic uranium mining, conversion, and enrichment industries supported the strategy and praised the Department for adding much needed clarity to its plans to introduce the Department's inventories of depleted, natural, and enriched uranium into the commercial market. In summer 2008, however, the Department announced that it would use some of its natural uranium inventories to compensate contractors for additional cleanup work at its Portsmouth Gaseous Diffusion Plant. Such transfers were never envisioned nor addressed in the Department's December 2008 plan. In addition, the first transfer of 200 metric tons in December 2009 was awarded to USEC on a non-competitive basis, which was also contrary to the goals of the plan and your predecessor's March 2008 policy statement on the management of the Department's excess uranium. Understandably, the reaction of much of the domestic uranium industry has been negative. Please update the Subcommittee on the status of this activity, and please submit for the record all analysis which was performed to support the Department's contention that this initial transfer would not substantially disrupt the uranium market.

Assistant Secretary Triay: The second of four planned transfers of uranium to USEC occurred in March 2010. Subsequent transfers to USEC are planned for each of the two remaining quarters in FY 2010. Attached are the market impact analysis and Secretarial Determination that support the determination that the transfers will not result in an adverse material impact on the domestic uranium industry.

Question: Does the Department agree that this December 2009 transfer of natural uranium to USEC was not specifically addressed in its December 2008 plan?

Assistant Secretary Triay: Yes, this unplanned transfer was not identified specifically in the December 2008 plan; however, it was conducted in a manner consistent with the principles and objectives of the December 2008 plan. This emergent effort was required to support the accelerated cleanup initiative at the Portsmouth Gaseous Diffusion Plant.

Question: What useful purpose does the Excess Uranium Inventory Management Plan serve if the Department fails to follow it?

Assistant Secretary Triay: The Excess Uranium Inventory Management Plan serves a useful purpose as a dynamic, not static, management tool designed to identify and provide public visibility to the DOE excess inventories, the planned or potential DOE disposition or sales initiatives that could impact the domestic market, and the DOE approaches to accommodate those market concerns.

Question: Does the Department intend to engage in future uranium transactions similar to the December 2009 transfer and, if so, will it update its December 2008 plan accordingly?

Assistant Secretary Triay: Additional transfers as described above are planned for FY 2010. As indicated in the Plan, the Department "expects to periodically update the Plan to reflect new and evolving information, policies and programs."

Question: Will the Department commit to engaging in future uranium market transactions solely on a competitive basis and, if not, under what specific circumstances would the Department choose to use means other than full and open competition?

Assistant Secretary Triay: EM expects to conduct any future uranium transactions on a competitive basis. The sole source award to USEC, conducted in accordance with applicable law, was necessary and in the public interest based upon factors such as the urgent need and that USEC was already performing work under an existing contract due to expire at the end of FY2010.

Question: What steps can the Department take to further improve the transparency of its uranium market transactions and avoid the negative reaction it has received from domestic uranium miners, converters, and enrichers?

Assistant Secretary Triay: The Department solicited significant input from involved stakeholders during the development of the December 2008 plan, including conducting a public meeting and numerous discussions with Congressional staff, industry groups, and consortia. As the Department develops updates to the Excess Uranium Inventory Management Plan it will involve and request input as appropriate from all interested and potentially impacted uranium miners, enrichers, and end users.

81. VALUE OF DEPLETED URANIUM

Question: The Department manages about 700,000 metric tons of depleted uranium tails at its facilities in Portsmouth, Ohio and Paducah, Kentucky. Although historically considered a waste product, a fraction of this material is potentially valuable at higher commercial uranium prices if re-enriched to natural or enriched uranium. In early 2008, the Government Accountability Office estimated the potentially valuable material to be worth over $7 billion at current uranium prices and recommended that the Department act quickly to develop a plan to take advantage of market conditions to potentially market its depleted uranium. Although the Department developed its Excess Uranium Inventory Management Plan in December 2008, it contained few specifics on how the Department planned to utilize its depleted uranium and the Department has taken no action on converting its potentially valuable tails into a form that would be more marketable in favorable uranium market conditions. Uranium prices have fallen considerably since 2008 and, as a result of the Department's failure to act in a timely way, the Treasury has been deprived of potentially billions of forgone revenue. What assurances can the Department provide that, if uranium market conditions merit marketing tails in the future, the Department will be able to act more nimbly than it has in the past to take advantage of the large amounts of potential revenue?

Assistant Secretary Triay: The opportunity to take advantage of more favorable market conditions must be weighed against the impact on other market participants. In addition, the Government Accountability Office estimated the opportunity and value at a time when there were large swings in market value of uranium. Selling large inventories of uranium under those market conditions could have had significant impacts on the domestic uranium mining industry, and the question implies that DOE would appropriately attempt to time these market swings. Most investment advisors caution against attempts to time markets, since professional money managers are likely to be able to take advantage of price swings in ways that less sophisticated investors may not. The Department believes that a prudent and transparent asset management plan is the correct approach to asset management, and that market timing efforts would be inappropriate for a government agency. As it updates its Plan, the Department will continue to take into account the market for this material and the effect on the market of Departmental sales and transfers of this material.

Question: To what degree are there commercial entities interested in purchasing the more commercially valuable tails either currently or in the future?

Assistant Secretary Triay: During the past three years, several commercial entities expressed interest in the highest assay of DOE uranium tails. However, DOE has not received any formal offers.

Question: To what extent is there sufficient commercial enrichment capacity available to re-enrich the Department's tails into natural or enriched uranium? How much does the Department estimate such re-enrichment would cost?

Assistant Secretary Triay: Currently, there is limited domestic uranium enrichment capacity. New domestic enrichment capacity, in the form of centrifuge designs, is currently under construction to replace the aged and inefficient domestic Gaseous Diffusion Plants. Depleted uranium processing costs are expected to decline significantly as a result of these new designs. However, the new enrichment plant designs will not initially include depleted uranium processing capability. Cost and pricing data for centrifuge processing of the depleted material is not expected to be available for several years and will be directly linked to the variable costs in the market place at the time of production.

Question: Will the Department revise its December 2008 Excess Uranium Inventory Management Plan to, as the Government Accountability Office recommended, detail the specific uranium market conditions under which the Department would choose to market its depleted uranium inventories?

Assistant Secretary Triay: DOE is in the process of updating its Excess Uranium Inventory Management Plan, and will address market conditions, and other factors, that will influence planning for future uranium management transactions.

82. OFFICE OF LEGACY MANAGEMENT FUTURE PLANS AND PROGRESS

Question: What sites of any significant size will be completed and what site responsibilities will be moved over to your office for long-term stewardship?

Assistant Secretary Geiser: Responsibility for the Mound/Miamisburg, OH site will be transferring to LM from EM on 10/01/10. LM will be responsible for the long-term surveillance and maintenance, which will include the operation and maintenance of all remedial action systems along with routine site inspections and maintenance. LM is also responsible for all records management activities, stakeholder support, and the administration of all pension and benefits payments to former Mound site contractor employees.

Question: What are the strategic challenges you face as the Office of Environmental clean-up completes its work at sites?

Assistant Secretary Geiser: LM recognizes its post-closure site responsibilities have to be managed in a long-term sustainable manner that continues to be protective of human health and the environment. LM faces the challenge of managing very diverse sites, which are regulated by a wide variety of regulatory agencies and changing regulations. LM must maintain a highly technical staff, deployed in many locations across the country to actively manage sites in over two dozen states, tribal nations and Puerto Rico. LM is keenly aware that these challenges can best be addressed through close coordination of legacy management activities with stakeholders, Congress, regulators, and state, tribal, and local governments.

Question: Please walk us through how a site transitions to your responsibility in terms of the activities you continue and initiate.

Assistant Secretary Geiser: Legacy Management uses a site transition process upon site cleanup and completion. The transition process is the passage from the phase during which engineered, near-term actions are taken to mitigate environmental and human health risks to the next phase where residual risks are maintained in a sustainable safe condition to allow beneficial use. The primary DOE Orders that govern this transition process are DOE Orders 430.1B and DOE O.413.3.

Seven fundamental steps are implemented during the transition process to ensure a successful transfer from EM to LM. Similar processes are used for transfers from the Nuclear Regulatory Commission for Uranium Mill Tailings Radiation Control Act sites and with the U.S. Army Corps of Engineers for Formerly Utilized Sites Remedial Action Program locations. The following is an outline of the seven steps:

1. **Notification** - The transition process is initiated when the existing site management entity such as EM notifies LM that EM is nearing mission completion at a site. There is no specific period of advance notification required, however the size of the site for which responsibility is being transferred should be considered (e.g., four-six months for a small site and two years or longer for a large site).

2. **Site Transition Plan** - A Site Transition Plan is jointly developed, approved, and executed. The plan includes all actions that must be either completed or transferred, identifies the responsible parties and the required outcome.
3. **Long-Term Surveillance and Maintenance (LTS&M) Requirements** - A LTS&M Plan is drafted by LM whereby post-closure activities are identified and documented. The LTS&M Plan describes those actions that are required to maintain the protection of the remedy; manage the natural, cultural, and historical resources, and involve and inform the public.
4. **Communication and Outreach** - Communication with the site's stakeholders and regulatory agencies builds on existing communication and outreach efforts.
5. **Budget and Authority Documentation** - Cost Estimates and the Program Budget Decision (PBD) documentation is jointly developed and approved to assure appropriate estimates are developed for the post-closure management of the site.
6. **Verification of Readiness** - A project completion package is prepared and stands as the final agreement regarding the "conditions" of the site and associated activities at the time of the transfer. The package is prepared in accordance with DOE's Project Management Order and validates the successful execution of the transition from remediation to long-term surveillance and maintenance.
7. **Transfer** - Once the budget request has been approved by Congress and the project completion package is signed, the site is officially transferred.

83. PENSIONS

Question: You are responsible for the pensions at the closure sites. The request is $122 million, $4 million less than fiscal year 2010. This would suggest the pension plans in your organization are in fairly good health. Do you foresee any issues on this front in the coming year?

Mr. Geiser: We do not expect any cost issues on the pensions because (1) the pension plans of the closure sites are funded above the 80% level and (2) most of the assets are currently invested conservatively in bonds to ensure that the funded status remains above 80% and minimize cost fluctuations.

WEDNESDAY, MARCH 17, 2010.

DEPARTMENT OF ENERGY: ENERGY EFFICIENCY AND RENEWABLE ENERGY, FOSSIL ENERGY, ELECTRICITY DELIVERY AND ENERGY RELIABILITY, FY2011 BUDGET

WITNESSES

KRISTINA JOHNSON, UNDER SECRETARY OF ENERGY
CATHY ZOI, ASSISTANT SECRETARY FOR ENERGY, RENEWABLE ENERGY
JAMES MARKOWSKY, ASSISTANT SECRETARY FOR FOSSIL ENERGY
PATRICIA A. HOFFMAN, DIRECTOR, ELECTRICITY DELIVERY AND ENERGY RELIABILITY

Mr. PASTOR [presiding]. The hearing will come to order.

Good morning. The Subcommittee on Energy and Water Development meets today to hear testimony on the fiscal year 2011 budget request for the Department of Energy's applied research and development programs in the area of energy efficiency, renewable energy, fossil energy, and electricity delivery systems.

America faces persistent challenges to its energy sector that continue to threaten our economy, national security, and environment. Our economy, from our citizens' cars to our military's planes, relies heavily on petroleum fuels, much of which is imported from overseas. Power prices have been rising for years, and our electricity supplies depend on energy sources that give off harmful emissions and are delivered on a congested and aging electric power grid.

Today we consider the budget requests for the applied research and development activities at the Department of Energy aimed at addressing these difficult challenges.

We have before us the Under Secretary of Energy, Dr. Kristina Johnson, who oversees the Department's applied research and development offices. We especially look forward to her account of the measures she has taken to break down the stovepipe mentality at the Department so that we may have better cooperation across the offices and programs.

We also have before us Assistant Secretary Cathy Zoi, to discuss the administration's fiscal 2011 request for energy efficiency and renewable energy. Assistant Secretary Zoi will discuss the administration's work on technologies that will reduce our energy consumption, decrease our dependence on petroleum fuels, and provide clean domestic renewable energy. Currently, most of our electricity comes from fossil energy sources.

And James Markowsky, Assistant Secretary for Fossil Energy, is here to discuss the Department's work on technologies that will provide cleaner, low-carbon electricity generation using our vast domestic resources of coal and natural gas.

Finally, Ms. Patricia Hoffman, Acting Secretary of Electricity Delivery and Energy Reliability, will address the Department's budget request for research and development activities that will squeeze more out of our existing resources and allow the expansion of clean energy generation by modernizing and securing the Nation's electricity transmission and distribution system.

Good morning, and welcome to all of you. I would ask you to keep your testimony today to no more than 5 minutes. We have your written testimony, and it is entered in the record. After the hearing, we may have some questions for you to answer for the record.

And, Secretary Johnson, we ask that you ensure that responses and any supporting information requested by the subcommittee are delivered in final form no later than 4 weeks from today. If members have additional questions, we ask them to submit to the subcommittee by 5 p.m. tomorrow.

With these opening comments, I would like to yield time to our Ranking Member for any opening comments that he would like to make.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman. I also would like to welcome all of our panelists here this morning.

Considering the energy needs in this country today and the expected rapid growth in demand, you each hold positions vital to meeting these challenges.

I can't help but recall that during the summer of 2008 when we watched the average price of gasoline peak at nearly $4.20, for most vehicles back then, large vehicles, it cost over $75 to fill at the pump. Household and Federal budgets exploded. At that time, I hoped we had been shocked enough to now be on a sustained path towards energy independence.

Today, gas prices average about $2.80 per gallon. In my view, any suggestion that these prices have normalized would be indicative of the larger problem that we must be sure to avoid, and that is complacency. I believe we are at a defining moment: A comprehensive, strategic approach towards increasing energy independence must remain a top national priority.

Whether it is wind, solar or hydropower, energy-efficient retrofits for homes, businesses and buildings, plug-in electric vehicles, innovative carbon capture technologies, nuclear energy, or transmission reliability, we must embrace all of the inclusive solutions. Energy independence is not only fundamental to a healthy economy, it also truly is a national security issue. The Department of Energy should be, as they say, at the tip of the spear. I am sure we would all agree with that, but we can't neglect the fact that we are slowly recovering from a near economic collapse.

Mr. Chairman, I don't question the government's role investing these important programs, but I must express my desire to see this administration exercise some level of fiscal restraint.

We simply cannot discount what was provided as emergency spending in the stimulus, Mr. Chairman. That historic piece of legislation provided the Department of Energy approximately $37 billion, 28 percent more than what is being requested by this budget for the entire Department.

For the three programs before us today, the stimulus provided $25 billion; yet nearly 96 percent of these funds have not been spent since the act was signed over 13 months ago. Additionally, the $3.1 billion request before us would increase these programs by nearly $500 million since the start of this administration.

I do recognize changing priorities, Mr. Chairman, but no matter how you look at it, this is an enormous sum of money to pump into these programs in a span of just 2 years, and, I may say, a good portion of that being borrowed.

As we consider this request, we must be mindful that just as energy security is a matter of national security, so too are exploding budget deficits and an insurmountable national debt. If we don't address that issue, we can have some pretty catastrophic financial consequences.

With that said, Mr. Chairman, I am very pleased to have a very well-educated panel before us. I didn't look over the resumes. I am sure that they will serve the administration well—and have been, and will serve the Nation well. And so welcome. Thank you.

Mr. PASTOR. Secretary Johnson.

Ms. JOHNSON. Thank you very much.

Mr. Chairman, Ranking Member Frelinghuysen, members of the committee, thank you for the opportunity for us to appear before you today to discuss the President's fiscal year 2011 budget request.

Secretary Chu calls the clean energy economy the industrial revolution of our time. And while reducing our dependence on imported oil, jump-starting our economy, and reducing greenhouse gas emissions present enormous challenges, we see these challenges as opportunities; the opportunity to help get America back to work, the opportunity to rebuild our manufacturing base, and the opportunity to leave our children the legacy of a robust economy, a clean environment, and a secure energy future.

As an engineer, I believe that solutions to problems require elegant design under constraint, and we recognize the constraints that we are dealing with. We face constraints in time, scale, and cost. The threats to our security, economy, and global climate are real, and we must act now. We have finite resources, we recognize that, and we must scale the benefits of energy savings in a clean energy economy to everyone in our country.

Under these constraints, I am pleased to report how DOE is responding to our energy challenge. We are more focused, we are more strategic, and we are more innovative in the way we are planning our R&D programs.

In the interest of time, I am going to describe one area that illustrates the new DOE, the one that is breaking down the silos that have traditionally existed in the Department. And then I will briefly highlight the President's 2011 energy budget request.

DOE is focusing resources on use-inspired research and development; that is, R&D inspired by big, real-world problems that are not amenable to business-as-usual solutions. We are coordinating and cooperating across the Department in ways we have never done before, and that helps us plan our research to minimize duplication and maximize success.

Let me give you an example. One of the barriers to growing a clean energy economy is the integration of renewable energy, such as solar and wind power, onto the Nation's grid. This is a multifaceted problem. So you might ask, what is the problem? Well, the problem is the sun doesn't shine all the time and the wind doesn't blow all the time. This intermittency means we need to store energy, to use it when we need it, not when we have it, which is the situation today.

The problem is also multiscale. Utilities need energy storage at large scales to power cities, and consumers need energy on small scales to power cars. We have taken care to strategically plan what kind of research is strategic and appropriate at each scale. That is why we fund energy storage in our core programs in the Office of Science, OE and EERE, and in new innovative programs, such as the Energy Frontier Research Centers, the Advanced Research Projects Agency for Energy and Energy Hubs. Each uses use-inspired research at different scales, with different objectives.

Specifically, the Energy Frontier Centers involve small groups of researchers at universities studying fundamental properties and structure of energy storage. In the interest of time, I won't go through them, but if you would like, I would be glad to talk about them during the Q&A.

Without this understanding, we can't make cheaper, more energy-intensive batteries to drive our vehicles 300 miles without recharging. So Energy Frontier Centers are about fundamental science at universities.

ARPA–E funds small groups of researchers, mainly in industry, working on technology breakthroughs. For example, we funded a company that is developing an all-liquid metal battery using domestically available materials, which has the opportunity to reduce the cost and increase the energy intensity by a factor of ten, which allows us to afford electric vehicles that go further on a single charge. It is game-changing technology that we are after.

EFRCs are fundamental science, ARPA–E is fundamental breakthroughs in technology. Both were funded under the Recovery Act, and we are requesting funding in the 2011 budget to sustain the momentum created by these two innovative programs.

The third innovative strategy is the Energy Innovation Hubs. It is called a hub because it integrates like spokes on a wheel the work we are doing in each of the core program offices as well as the work in ARPA–E and the Energy Research Centers.

Hubs are about scale. They involve large, multidisciplinary, and highly collaborative teams of scientists and engineers working together, from universities, government, and industry under one roof. They are looking at fundamental science and technology at the scale needed to meet our energy challenges.

The proposed Energy Storage Hub will investigate the ultimate limit in storage materials and demonstrate their applications: large scale for utilities, and small-scale batteries for applications in electric vehicles. This is being coordinated across all of DOE by the Energy Storage Working Group led by Acting Assistant Secretary Patricia Hoffman.

Now to the budget highlights. The Office of the Under Secretary of Energy includes six major program offices—Energy Efficiency and Renewable Energy, Fossil Energy, the Office of Electricity Delivery and Energy Reliability, Nuclear Energy, Environmental Management and Legacy Management. Each of the Assistant Secretaries here will go into detail in those programs.

In the interest of time, I would just like to conclude by talking about one crosscutting example in the education space. Our country is facing a perfect storm in education. At exactly the time that 40 percent of our energy workforce will be of retirement age in the next decade, less than 16 percent of our high school students can pass a science and math competency test, and less than 1 percent excels. Less than 4.4 percent of our students entering college go into engineering, and not all of them graduate engineering.

This is exactly the time we need to invest in a program like RE-ENERGYSE, or REgaining our ENERGY and Scientific Edge. It is this kind of program that I would like to have the opportunity at some other time to talk about in more detail. But it is critically important to fund the next generation of bachelors, masters, doctoral students, as well as curriculum at the community college level to train workers for this new clean energy economy.

So let me conclude by saying thank you for the opportunity to speak in front of this committee today. I look forward to answering any question that you or other members of the committee may have.

Thank you.

Mr. PASTOR. Thank you.

[The information follows:]

Statement of Kristina Johnson
Under Secretary for Energy

Before the

House Committee on Appropriations
Subcommittee on Energy and Water Development and Related Agencies

Regarding the FY 2011 Budget
March 17, 2010

Mr. Chairman, Ranking Member Frelinghuysen, Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's fiscal year 2011 budget request.

In his State of the Union address several weeks ago, the President reiterated how important clean energy will be to the country's competitiveness going forward: "The nation that leads the world in creating new sources of clean energy will be the nation that leads the 21st century global economy." I repeat this quote before you today because this view frames the Department's mission and guides our energy investments.

I would like to describe the big picture view of these energy investments in the President's FY 2011 Budget and describe how the Office of the Under Secretary of Energy is coordinating efforts across program offices. I will then highlight a few initiatives and proposed funding shifts. I will close with an update on our progress in implementing the American Recovery and Reinvestment Act.

DOE Approach to Energy Investments

This administration is committed to fulfilling the many opportunities inherent in developing new technologies that enable our Country to produce and use energy in cleaner smarter ways while also paving the way for what Secretary Chu calls "the next Industrial Revolution." Few sectors of the economy hold as much promise as energy when it comes to encouraging widespread impact. By investing in clean energy industries and technologies, we can create jobs and strengthen America's economic standing at home and abroad, reduce our dependence on oil, and become better stewards of our environment.

The United States is in an enviable position in delivering on these opportunities. We are a nation of innovators. Innovation is a cornerstone of American prosperity, and the primary source of our economic competitiveness. We jumpstarted the global manufacturing industry and redefined transportation in the 19th century, and our more recent breakthroughs in biotechnology and computer science have helped us retain our competitive edge.

Yet as we seek to take this expertise and apply it to our energy sector, we find ourselves limited by three intertwined constraints: cost, speed and scale. We know that it takes enormous amounts of capital to develop and deploy new energy technologies that can help the nation achieve energy security and environmental goals. At the same time, we face a difficult deficit situation..

From the outset, we will have to be three things if we are to achieve our mutual goals of standing up a clean energy economy, securing our energy future and safeguarding our environment. Those three things are: innovative, efficient, and focused.

First, I want to talk about how the Department is encouraging those attributes with respect to our energy research and development enterprise. The challenge we face is that despite years of important contributions made by DOE science and engineering in energy-related fields, we are still confronted by the fundamental problems tied to our energy use: oil dependence and environmental degradation.

Given the urgency of our energy and environmental challenges, we believe new and innovative approaches to research and development are warranted – approaches that cultivate *use-inspired* research by bridging fundamental and applied science and engineering. There are plenty of precedents for what we're encouraging. In fact, we as a nation have enjoyed a long history of use-inspired fundamental advances, from understanding the origins of the great influenza, to the development of radar in World War II and the invention of the transistor at Bell Laboratories and the information technology revolution..

In the pursuit of replicating discoveries such as these in energy-related fields, we have designed three cross-cutting approaches that cover the spectrum of fundamental to applied science and engineering to maximize our chances of transformational energy breakthroughs making it into the marketplace, thus growing the clean energy economy.

The first approach, Energy Frontier Research Centers (EFRCs), involve collaborations among small groups of researchers that are focused on overcoming known hurdles in basic science that block energy breakthroughs. Major areas of emphasis will be in fundamental sciences that can be tied in the future to specific commercial uses, such as carbon capture and sequestration, and advanced nuclear energy systems.

The Advanced Research Projects Agency for Energy, or ARPA-E, is the second approach. It involves a highly entrepreneurial funding model that explores potentially revolutionary technologies that have gone unfunded by industry. Unlike the EFRCs, the work conducted at ARPA-E is technology-oriented. We seek to fund the boldest and best ideas for potentially transformative technologies.

The third approach is the Energy Innovation Hubs. Research conducted at the Hubs involves large, multi-disciplinary, joining highly collaborative teams of scientists and engineers working largely under one roof to integrate knowledge at the systems level to scale solutions to our Nation's energy challenges. This knowledge will come from advances in our core RD&D energy programs, fundamental breakthroughs from the EFRCs and game-changing technology from ARPA-E.

All three approaches are complemented by ongoing core fundamental R&D, as well as applied R&D, that seeks to address technological challenges in concert with industry, national lab, university, and State partners.

Management and Planning

The Department is also paying special attention to making our research programs more efficient and focused. We're taking this task on by reformulating the way we plan, select and execute on research projects that are funded through DOE contracts and grants.

Let me give you some examples. The Office of the Under Secretary formed an Assistant Secretary Cabinet, which meets weekly to discuss our research goals and coordinate our upcoming programs to ensure a coherent research strategy. The group also addresses cross-cutting management challenges. To help identify challenges and collaborative opportunities for our labs, we also established a new applied laboratories directors council, which meets quarterly with the Under Secretary and Assistant Secretaries.

In addition, we are improving our peer review process after assessing its quality and examining best practices across the Department. We are developing quality criteria for reviewers, diversifying the pool of available experts, and identifying ways to recruit and retain high quality peer reviewers who are recognized experts in their respective fields.

We are looking for ways to better plan and implement our research, development, demonstration, and deployment (RDD&D) efforts for crosscutting programs, such as energy storage. Offices with current efforts in energy storage RDD&D include EERE, OE, ARPA-E, the Office of Science, and the Loan Program Office. These offices have clearly defined roles and responsibilities consistent with their missions. At the same time, they are planning joint workshops to help identify RDD&D needs, participating in the review of each other's projects, and hosting regular coordination meetings to ensure no duplication of efforts. The Department has established a standing Working Group on Energy Storage to ensure continued collaboration and coordination.

2011 Budget Highlights and Initiatives

The Office of the Under Secretary for Energy includes six major program offices: Energy Efficiency and Renewable Energy (EERE), Fossil Energy (FE), Office of Electricity Delivery and Energy Reliability (OE), Nuclear Energy (NE), Environmental Management (EM), and Legacy Management (LM), as well as Civilian Radioactive Waste Management (RW), which the Department plans to transition to other offices.

The 2011 budget request for these programs is $10.5 billion, more than one third of the Department's overall request of $28.4 billion. Focusing on EERE, FE, and OE in this hearing, there are several significant changes compared with the FY 2010 appropriations.

EERE has the largest net increase, $113 million, in the budget request, reflecting our commitment to developing the renewable energy sector and improving energy efficiency in all sectors of the economy. The EERE request of $2.4 billion includes increases of $55 million (22 percent) for the Solar Energy Technology Program, $42.5 million (53 percent) for the Wind Energy Program, and $14 million (4.5 percent) for the Vehicle Technologies Program.

One important initiative within EERE is a $10 million request within the Industrial Technologies program for Manufacturing Energy Systems Partnerships (MESPs). This program is focused on helping accelerate the most promising clean energy technologies into the manufacturing sector, thus creating good-paying jobs and helping get Americans back to work. The MESPs engage private sector engineers and technologists who know how to manufacture goods at scale and low-cost, to work with scientists and engineers carrying out the fundamental and applied clean energy research and development. Designing fundamental research programs with cost and manufacturing feasibility in mind will reduce the time necessary to translate innovation into commercial processes, products and companies. Our proposal would fund consortia at several premier U.S. universities, and leaders from academia, industry, and National Laboratories.

This manufacturing initiative is consistent with the spirit of Section 656 of the Energy Independence and Security Act of 2007. Specifically, Section 656 authorizes the Renewable Energy Innovation Manufacturing Partnership. While we would expand the intent beyond renewables to include energy efficiency technologies, the key elements of the stated purpose of this provision still apply. In short, we aim to "develop...advanced manufacturing processes, materials, and infrastructure" through awards to consortia, which can reduce the time from concept to market for innovative energy technology ideas that can help reduce the nation's greenhouse gas emissions and increase the nation's energy security.

The budget request for OE is $186 million, $14 million (8 percent) more than 2010 appropriations. There are two major funding shifts. First, we are proposing to nearly triple the energy storage budget from $14 million to $40 million. The OE program will increase its highly leveraged participation with state energy agencies, utility companies, and end users to field test energy storage systems to evaluate readiness for commercial market entry. With the increase in funding, the OE program will be able to evaluate several technology pathways simultaneously rather than serially, shortening the development path to commercial market entry. Secondly, the FY 2011 request winds down DOE's involvement in high temperature superconductivity wire research (HTS), providing $5 million for orderly closeout activities. After investing over $600 million over the past 20 years, the Department believes that HTS wire research has reached a point that provides meaningful technical value, and that HTS wire technology developed at the DOE National Laboratories is ready for transition to a U.S. manufacturing base. OE will continue to coordinate closely with the Office of Science, which conducts fundamental research on superconductivity, such as the discovery of new superconducting materials.

The budget request for FE is $760 million, a decrease of $191 million (20 percent). The request continues strong support for coal research related to carbon capture and storage (CCS), including $20 million for modeling and simulation of CCS systems that could save millions of dollars in the long run by helping avoid costly demonstration steps. The request for FE also reflects the Administration's commitment to fiscal responsibility and the ability to prioritize our work. We are proposing to terminate the Unconventional Fossil Energy Technologies program, saving $20 million, as we believe industry is capable of continuing this research on its own. [The budget request for the Strategic Petroleum Reserve is $139 million. It includes the cancelation of $71 million in previously appropriated balances, which we are proposing to dedicate in FY 2011 to continuing operations of the SPR. We are also proposing to transfer methane hydrates research to the Office of Science, where similar work is ongoing.

One crosscutting initiative that I'd like to highlight is RE-ENERGYSE, or REgaining our ENERGY and Scientific Edge. RE-ENERGYSE is a $55 million collaborative effort which includes EERE ($50 million) and NE ($5 million) and involves close coordination with the Offices of Science, the National Science Foundation, and other agencies. This initiative is aimed at filling the gaps in the energy workforce pipeline by training current and future generations of energy professionals through fellowships for higher education, energy-focused curriculum development for technical training, and K-12 education and outreach. We have extensively surveyed existing educational activities within the Department and in other agencies and found that we lack a coordinated funding approach for these proposed activities. RE-ENERGYSE will focus on engineering and applied sciences, separate and distinct from existing Office of Science educational programs focused on basic science and experiential teacher training. RE-ENERGYSE will also, however, tap into existing Department resources to administer fellowships and coordinate other activities.

Our RE-ENERGYSE request is consistent with the spirit and intent of several authorizing provisions in the America COMPETES Act of 2007. For example, Section 5003 of the Act authorizes the Secretary to establish the Protecting America's Competitive Edge (PACE) Graduate Fellowship Program. Eligibility criteria for students applying for fellowships under this program include: the pursuit of a field of science or engineering of importance to a mission area of the Department; imagination and creativity; leadership skills in organizations or intellectual endeavors; and excellent verbal and communication skills to explain, defend, and demonstrate an understanding of technical subjects relating to the fellowship. These are exactly the types of students to whom we would like to award fellowships through RE-ENERGYSE.

As President Obama said on April 29, 2009: "RE-ENERGYSE is...an educational campaign to capture the imagination of young people who can help us meet the energy challenge...Energy is this generation's greatest project. America's young people will rise to the challenge if given the opportunity – if called upon to join a cause larger than themselves." The Administration looks forward to working with the Committee and other Members of Congress to help make this vision and program a reality.

American Recovery and Reinvestment Act (Recovery Act)

I understand this Committee, the Congress, and the American people have a continued interest in our progress in implementing the Recovery Act. Thanks in large part to this legislation, we are well on our way to fulfilling the President's goals: achieving global energy leadership, encouraging innovation, and increasing our security.

Importantly, our economy is growing again after two years of recession. In just the past few weeks, we have learned from preliminary data reported by industry that: the US solar industry grew by almost 40 percent in 2009 and added 18,000 new jobs;[1] the US wind industry – after warning of a 50 percent drop in development for 2009 – installed more than 9.9 gigawatts of new generating capacity, creating thousands of new jobs along the way;[2] and – thanks once again to the Recovery Act – that America's geothermal industry saw a 46 percent uptick in confirmed new power projects last year.[3] There can be little doubt that the Recovery Act's Treasury grants in lieu of tax credits program (1603), along with the expanded manufacturing tax credit (48C), were big contributors to the expansion of these important industries.

Small businesses are major players in our economic recovery. As of last month, more than 200 small businesses benefited from DOE Recovery Act funding, through almost $1.6 billion in grants and contracts, and nearly $1.9 billion in conditional loan guarantee commitments. We also increased the number and size of Small Business Innovation Research (SBIR) grants funded by the Recovery act to promote commercialization and job creation.

When the Recovery Act legislation was passed nearly a year ago, the DOE received $36.7 billion in direct funding to jump-start the clean energy economy. I am happy to report that, as of last week, we have selected $31.4 billion worth of specific projects to receive contracts and grants, and have obligated $25.9 billion. Accounting for private industry cost share and the impact of loan guarantees, we expect to support an estimated $100 billion in clean energy and environmental projects. These investments have targeted needs across the technology portfolio and at companies both big and small. Recovery Act funding has also helped create demand for energy efficient products and helped businesses and consumers save money, through investments in suppliers, weatherization support to local agencies, and partnerships with cities, counties, and states to create and expand energy efficiency programs.

Finally, the Recovery Act has given educational institutions and national laboratories a financial shot in the arm. We have obligated almost $600 million to colleges and universities to provide the research and training required to achieve our long-term goals. The national labs were able to expand their research mission significantly, with a combined $3.3 billion in funding. And our state and local partners received over $11 billion under DOE partnerships supporting their activities in energy efficiency, renewable energy, and modernizing the grid.

---

[1] http://www.seia.org/cs/news_detail?pressrelease.id=707

[2] http://www.awea.org/newsroom/releases/01-26-10_AWEA_Q4_and_Year-End_Report_Release.html

[3] http://www.renewableenergyworld.com/rea/news/print/article/2010/01/us-geothermal-industry-hits-3-gw-in-2009

The FY 2011 budget request builds on the investments in the Recovery Act. Through the $36.7 billion the Department received under the Recovery Act, we are putting Americans to work, while helping to build a clean energy economy, spur energy innovation, and reduce our dependence on oil. We've begun to make our homes and offices more energy efficient, to modernize our grid, and to invest in key renewable energy projects. Getting this money out the door quickly, carefully, and transparently has been and will continue to be a top priority for the entire Department.

Mr. Chairman, this concludes my prepared statement. I look forward to answering any questions that you and other Members of the Committee may have. Thank you.

Mr. PASTOR. Secretary Zoi.

Ms. ZOI. Good morning, Mr. Chairman, Ranking Member Frelinghuysen, and distinguished members of the subcommittee. Thank you for the opportunity to appear before you today. I will share brief remarks this morning, and I have submitted a longer statement for the record.

I am excited about the clean energy future DOE and Congress have worked to create. As you know, vast renewable energy deployment and more efficient homes and businesses are essential to reaching that future. To that end, our focus in EERE is to combine high-impact innovation with the ingenuity and skill of the American workforce to tackle our economic, environmental, and energy security challenges. Each of these challenges is also an opportunity, and we are committed to creating clean energy jobs, reducing our reliance on foreign sources of energy, and combating climate change.

The President's fiscal year 2011 budget request of $2.355 billion for EERE will move the U.S. forward on these fronts. Our budget request is approximately $113 million more than our fiscal year 2010 appropriation, a 5 percent increase. These funds will help us leverage and build upon the $16.8 billion in investments EERE has made through the Recovery Act.

Through this budget, we will continue to demonstrate large-scale, replicable, renewable generation facilities, including concentrated solar power, offshore wind, and biopower projects. We will continue to transform the landscape of the Nation's transportation systems with new vehicles and new fuels. Our vehicles program is assisting manufacturers to ramp-up plug-in hybrid battery production to a capacity of a half million units per year by 2015.

We will continue to save taxpayers money and reduce greenhouse gas emissions by greening the Federal Government. Last October, the President issued an executive order leading to a 28 percent reduction target for Federal greenhouse gas emissions. EERE will lead collaboration across agencies to achieve that target by 2020.

We will endeavor to make America's manufacturing, construction, and other industries the most innovative and productive in the world, and we will facilitate building retrofits to dramatically reduce energy consumption. A more efficient America is a more competitive America. As Dr. Johnson mentioned, RE–ENERGYSE will support education and training for Americans to develop the skills needed by employers in the clean energy economy.

With the support of this subcommittee and this Congress, we can accomplish all of these goals and more. In order to meet those goals, though, we need a larger EERE team. Simply put, EERE staffing has not kept pace with our budget. From fiscal year 2006 to fiscal year 2010, EERE experienced a 93 percent budget increase, from $1.2 billion to $2.2 billion, while staffing only increased by 19 percent.

Increased funding for program direction is critical to effectively carrying out our mission on behalf of the taxpayers. As you know, our annual appropriations are only a part of the story. Tax credits, loan guarantees, rebates, and other mechanisms play a large role in the growth of clean energy production and smart energy use.

Mr. Chairman, and Members of Congress, I appreciate your leadership in providing the resources we need to accomplish our shared goal of a clean energy economy, and I would be pleased to respond to questions.

Mr. PASTOR. Thank you very much.

[The information follows:]

STATEMENT OF

CATHY ZOI

ASSISTANT SECRETARY FOR
ENERGY EFFICIENCY AND RENEWABLE ENERGY
U.S. DEPARTMENT OF ENERGY

BEFORE THE

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT
COMMITTEE ON APPROPRIATIONS
UNITED STATES HOUSE OF REPRESENTATIVES

MARCH 17, 2010

Mr. Chairman, Ranking Member Frelinghuysen, Members of the Subcommittee, thank you for the opportunity to testify on the President's Fiscal Year (FY) 2011 budget request for the Office of Energy Efficiency and Renewable Energy (EERE).

The President's FY 2011 budget request includes $2.355 billion for EERE, approximately $113 million (five percent) more than the FY 2010 appropriation. This represents an almost doubling of the budget request since FY 2006.[1] The FY 2011 budget will also help us leverage and build on the $16.8 billion EERE received under the American Recovery and Reinvestment Act (Recovery Act).

EERE's balanced portfolio of research, development, demonstration and deployment (RDD&D) and commercialization activities is helping to unleash unprecedented growth in renewable energy and efficiency technologies. This is only part of the story here – tax credits, loan guarantees, and other instruments are playing a substantial role in this growth.

Renewable energy capacity (excluding large-scale hydropower) has grown by 150 percent during the last eight years,[2] and the U.S. now leads the world in wind energy capacity and production.[3] Biofuels production has reached record levels, with the U.S. producing over 10 billion gallons annually.[4] In addition to energy supply gains, energy efficiency technologies have contributed to a 15 percent reduction in energy intensity (energy consumption per dollar of gross domestic product) for the U.S. economy since 2000.[5]

EERE continues to work to amplify these trends. With the continued leveraging of EERE technologies, EERE estimates that the achievement of all its program performance goals would significantly reduce U.S. net oil imports by over 50 percent, reduce carbon dioxide emissions by over 15 percent, save consumers over 20 percent on energy costs, and reduce primary energy consumption extrapolated to 2050 relative to EIA's baseline projections.[6]

---

[1] Internal EERE analysis of 10-Year budget trend FY 2002-2011

[2] Calculated based on year 2008 (38,493 MW capacity) compared with year 2000 (15,572 MW capacity) Renewable energy here includes wind, biomass, geothermal, solar thermal and photovoltaics. Source: U.S. Energy Information Administration. *Electric Power Annual 2008*. January 21, 2010. http://www.eia.doe.gov/cneaf/electricity/epa/epaxlfile1_1.pdf

[3] By the end of 2009, U.S. installed capacity was 35,159 MW. Source: American Wind Energy Association. *Year End 2009 Market Report*. January 2010.
http://www.awea.org/publications/reports/4Q09.pdf
Wind generation in Germany, the country with the next largest capacity, reached 25,777 MW in 2009. Source: European Wind Energy Association. *Wind in Power: 2009 European Statistics*. February 2010.
http://www.ewea.org/fileadmin/ewea_documents/documents/statistics/general_stats_2009.pdf
China's wind generation capacity increased in 2009 to a total of 25.1 GW which is now very close to Europe's capacity of 74,767 MW (source: Global Wind Energy Council, http://www.gwec.net/index.php?id=30&no_cache=1&L=rmduzbfytclp&tx_ttnews[tt_news]=247&tx_ttnews[backPid]=97&cHash=e7f10ef71a, Accessed March 5, 2010

[4] Data from U.S. Energy Information Administration, *Monthly Energy Review December 2009* and includes fuel ethanol and biodiesel production, and is projected to reach 10.7 million gallons for 2009. This reflects a 15 percent increase from 2008.

[5] The value of 15% is from 2008 data published by U.S. Energy Information Administration / Monthly Energy Review. December 2009.

Cumulatively, between 2011 and 2050, if technology leveraged by EERE programs can meet their program goals, they would help the U.S. reduce oil imports by approximately 30 billion barrels (approaching 10 years' worth of current passenger vehicle use),[7] save consumers and businesses more than $6 trillion in energy costs, and displace nearly 30 billion metric tons of carbon dioxide emissions and over 350 quadrillion British thermal units of primary energy.[8]

Some examples of noteworthy EERE program office accomplishments include:

- **The Industrial Technologies Program** won three *R&D 100* awards in 2009, continuing a history of being recognized for its work in Materials Science and Energy Intensive Process research activities. The *R&D 100*, also known as the "Oscars of Innovation," identifies the most promising technology products each year. DOE 2009 winners include the development of *ThermoMagnetic Processing for Heat Treating*, a transformational materials processing technology that offers significant energy savings through the elimination of heat treatment steps and the use of superconducting magnets. The Save Energy Now effort conducted more than 2,400 assessments from 2006 through November 2009 that identified potential energy and cost savings for manufacturers. The more than 2,200 plants with completed reports identified over $1.3 billion in potential cost savings per year, with $231 million per year already implemented and $437 million per year underway or scheduled.

- **The Federal Energy Management Program** (FEMP) helped Federal agencies save over 110 trillion lifecycle Btus, more than twice FEMP's annual target. In FY 2009, Super Energy Service Performance Contract (ESPC) awards are expected to generate project investments exceeding $440 million with a corresponding cumulative guaranteed energy savings of 85 trillion BTUs. These figures relate to FY 2009 investments and cumulative guaranteed savings over the contract term from the task order schedules.

- **Building Technologies Program** has addressed the Congressional finding that the program was late on issuing energy conservation standards and will issue final rules for six types of appliances in FY 2010, advance the work necessary to issue final rules for ten types of appliances in FY 2011, and continue to update test procedures and standards for additional product types. On September 30, 2009, the Environmental Protection Act (EPA) and DOE signed a Memorandum of Understanding (MOU) to more clearly define the Energy Star and the National

---

[6] Baseline projections are taken from U.S. Energy Information Administration, Office of Energy Markets and End Use. *Annual Energy Review*. Washington. June 2009. http://www.eia.doe.gov/aer/pdf/aer.pdf

[7] U.S. Energy Information Administration, Office of Energy Markets and End Use. *Annual Energy Review*. Washington. June, 2009. http://www.eia.doe.gov/aer/pdf/aer.pdf

[8] http://www1.eere.energy.gov/ba/pba/program_benefits.html

Building Rating Program between the two agencies. A Governing Council will ensure that work programs between EPA and DOE are complementary (and not duplicative) and leverage federal dollars to achieve maximum energy efficiency.[9] The program is demonstrating important advancements in new home construction (40% overall savings), new commercial building construction (50% overall savings), commercial building retrofits (30% overall savings), and for a number of the technologies that go into these buildings.

- **Biomass and Biorefinery Systems R&D** continues to make progress on integrated biorefinery projects at various scales and phases of construction, with 1.4 million gallons per year (mgpy) of cellulosic ethanol production capacity in Louisiana which is a demonstrated project and 2.5 mgpy biofuel capacity coming on line in Georgia in FY 2010 in support of the Energy Independence and Security Act (EISA) Renewable Fuel Standard (RFS) targets. The Georgia project is commercial in scope. An additional four biorefineries will move into the construction phase in FY2010 and plan to reach operating capacities of up to 37 mgpy (25 mgpy cellulosic ethanol and 11 mgpy FT Liquids as a diesel replacement) in FY2012 in Kansas, Iowa and Wisconsin. All of the projects named are funded by EERE. The program evaluated hundreds of applications and made awards to 5 Feedstock Logistics projects and 3 USDA-DOE joint solicitation projects in 7 states. The program produced multiple reports, including an updated intermediate blends testing report and a draft algae technology roadmap, to be finalized in FY2010. A series of workshops were also held to explore new initiatives in biopower and bioproducts, as well as obtain key stakeholder input to the high-yield scenario as part of the forthcoming update to the 2005 Billion-Ton Study.

- **The Vehicle Technologies Program** accelerated activities focused on developing and demonstrating plug-in hybrid components (batteries, electric motors, and power electronics) and vehicles. In FY 2009, the program also demonstrated a 44 percent improvement in engine efficiency over a comparable gasoline engine with a passenger diesel engine, modeled a passenger vehicle weight reduction of 40 percent, and supported efforts to begin commercialization of a lithium-ion battery supported by DOE.

- **The Geothermal Technologies Program** partnered with industry, the National Laboratories, and universities to achieve significant advancements in R&D. Significant FY 2010 accomplishments included:
    - Developing a Seismic Imaging Tool at Sandia National Laboratory;
    - Successfully testing Nano-Tracers at Stanford University;
    - Advancing "Spallation Drilling" (a process that promises much faster hard-rock drilling); and

---

[9] http://www.natresnet.org/hotnews/EPA_DOE_Agreement.pdf

  - Generating electricity from hot water co-produced at Rocky Mountain Oil Field Test Center, a first for the U.S. Currently treated as a waste product, the majority of "co-produced" geothermal resources are warm enough to generate electricity. This could provide additional value streams to extend the life of mature oil and gas fields, while adding a significant, clean source of electricity to America's energy portfolio.

- **The Solar Energy Technologies Program** worked with the private sector to develop modules producing over 40 percent more power per unit area than typical silicon-based modules, while reducing total system costs and producing more power in constrained locations like residential rooftops. A new 1.5 megawatt (MW) dish/engine power plant in Phoenix, Arizona, demonstrated a world record 31.2 percent solar-to-grid system conversion efficiency.

- **The Water Power Program** competitively selected over 30 partnerships with leading technology and project developers that will facilitate the deployment and testing of marine and hydrokinetic power systems and components, reduce technology costs and improve system performance, reduce deployment costs by leveraging environmental performance data, and determine the available, extractable energy from U.S. water resources. The program also launched an extensive research platform to test the Nation's first wave and tidal power systems, designed open-ocean renewable energy test facilities, and identified opportunities for increased incremental generation at hydroelectric facilities and non-electricity generating dams.

- **The Wind Energy Program** is using Recovery Act funds to establish large blade and gearbox testing facilities which will accommodate the rapid growth in wind turbine size and demand over the next two decades. These testing facilities will help enhance the performance, durability, and reliability of utility-scale wind turbines. The Wind Energy Program has been conducting independent testing and certification of distributed wind turbine technology since FY 2008. This activity will promote the widespread deployment of distributed wind energy by providing the information consumers and small businesses need to confidently invest in small wind turbines. For more than a decade, the program has partnered with industry to develop innovative concepts, components, and prototypes primarily for residential, farm, and industrial applications.

- **The Weatherization and Intergovernmental Activities Program** increased utilization of energy savings performance contracting, sustainable energy efficiency finance mechanisms, renewable energy certificate trading programs, and energy efficiency based utility incentives. The program also expanded the green workforce in the residential energy retrofit and other energy-related fields. The Weatherization Assistance Program is one of the largest and most technically advanced residential energy retrofit providers. Funds are allocated on a formula basis and awarded to States, U.S. Territories, the District of Columbia, and Native American tribal governments to increase the energy efficiency of homes occupied by low-income families. These agencies, in turn, contract with almost 900 local governmental or nonprofit agencies to deliver weatherization services to low-income clients in their areas. The FY 2011 target is to weatherize 33,484 low-income homes with regular appropriations.

EERE GOALS – FY 2011

Six overarching themes drive the FY 2011 EERE budget request, including:

1. Demonstrating large scale, quickly deployed, barrier busting replicable renewable generation facilities;
2. Rapidly building on and leveraging Recovery Act investments in renewable energy and energy efficiency technologies. Much of the requested increase is dedicated towards support of research and development and innovation. The mission of EERE is to undertake research and deployment activities advancing technologies to meet the growing global demand for clean, reliable, sustainable, and affordable energy services, and to reduce energy consumption;
3. Demonstrating Federal leadership in energy efficiency, reducing GHG emissions and increasing the use of renewable energy by the Department;
4. Transforming the technology, infrastructure and landscape of the Nation's transportation systems with new vehicles and new fuels;
5. Making America's manufacturing, construction, and other industries the most innovative and productive in the world; and
6. Supporting the education and training needed to give Americans with the skills needed by these new businesses—including use of state of the art training technology.

FY 2009-2011 BUDGET TABLE
ENERGY EFFICIENCY AND RENEWABLE ENERGY[10]

	FY 2009		FY 2010	FY 2011	FY 11 VS FY 10	
Programs	**Current Approp.**	**Current Recovery**	**Current Approp.**	**Congressional Request**	**$ Change**	**Percent Change (rounded)**
Biomass and Biorefinery R&D	214,215	777,138	220,000	220,000	0	0%
Vehicles Technologies	267,143	2,795,749	311,365	325,302	+13,937	4%
Hydrogen and Fuel Cell Technologies	164,638	42,967	174,000	137,000	-37,000	-21%
Geothermal Technology	43,322	393,106	44,000	55,000	+11,000	25%
Solar Energy	172,414	115,963	247,000	302,398	+55,398	22%
Water Power	39,082	31,667	50,000	40,488	-9,512	-19%
Wind Energy	54,370	106,932	80,000	122,500	+42,500	53%
Building Technologies	138,113	319,186	222,000	230,698	+8,698	4%
Federal Energy Management Program	22,000	22,388	32,000	42,272	+10,272	32%
Industrial Technologies	88,196	261,501	96,000	100,000	+4,000	4%
Weatherization and Intergovernmental	516,000	11,544,500	270,000	385,000	+115,000	43%
RE-ENERGYSE	0	0	0	50,000	+50,000	NA
Program Direction	127,620	80,000	140,000	200,008	+60,008	43%
Program Support	18,157	21,890	45,000	87,307	+42,307	94%
Facilities and Infrastructure	76,000	258,920	19,000	57,500	+38,500	203%
Congressionally-Directed Activities	228,803	0	292,135	0	-292,135	-100%
Use of Prior Year Balances	-13,238	0	0	0	0	NA
TOTAL, EERE	2,156,865[a]	16,771,907	2,242,500	2,355,473	+112,973	5%

[a] SBIR/STTR funding transferred to the Office of Science in FY 2009 was $19,327,840 for SBIR and $2,347,160 for STTR respectively.

PROGRAM SUMMARIES FOR FY 2011

Biomass and Biorefinery Systems Research and Development

The FY 2011 budget request of $220 million remains level to continue research development and deployment (RDD&D) investments supporting EISA and RFS targets. This builds on approximately $800 million of Recovery Act funds announced last May to accelerate advanced biofuels research and development and to provide additional funding for commercial-scale biorefinery demonstration projects.[11] The FY 2011 request for algal biofuels is approximately $4 million, and is intended to continue activities started in FY 2010 and include 1) resource assessments of the algae production inputs; 2) environmental assessments of the impacts of growing algae at scale, and 3) research of problems with the feedstock-fuel conversion interface. The results of this funding will inform activities being conducted within the Recovery Act funded Algal Biofuels Consortium and the pilot and demonstration facilities dedicated to algal biofuels.

---

[10] The FY 2011 Request for the Small Business Innovation Research Program and the Small Business Technology Transfer Program is a combined $25,821,000

[11] http://www1.eere.energy.gov/biomass/news_detail.html?news_id=12488

Strategic analysis and sustainability activities provide critical quantitative data, validation, and risk and feasibility assessments to inform programmatic decision-making and strategic planning. The program is launching an effort for biopower in FY 2011 through an initiative involving large commercial demonstration projects comparable to biorefineries at scale. As with the program's biorefinery projects, this new initiative will address the entire supply chain from feedstock cultivation to large scale power generation, providing clean energy solutions for an emerging low carbon economy. The Biomass Program proposes subprogram restructurings in order to better highlight these and other key activities.

Building Technologies

The FY 2011 budget request of $230.7 million allocates an additional $8.7 million (4 percent) above FY 2010 appropriated levels to the high-priority Building Technologies Program's efforts. By working to make new and existing homes and buildings more energy efficient, DOE is helping to deliver significant primary energy savings today. With even greater future savings in the pipeline, the program is building the foundation for significant future reductions in the carbon footprint of the built environment. R&D for residential and commercial buildings integration focuses on reducing building energy requirements and incorporating renewable energy systems to enable commercial production of net zero energy homes and buildings by 2020 and 2025, respectively. The portfolio of energy efficiency components research, aligned to reduce building electrical loads, includes solid state lighting, more affordable efficient windows, and more efficient heating, ventilation, air conditioning, and refrigeration. The program pursues market transformation activities by developing and disseminating model building codes that are 30 percent more efficient than current codes in both the residential and commercial sectors. The program will continue to clear the backlog of rulemakings for appliances and commercial equipment and meet Energy Policy Act of 2005 (EPAct 2005) and EISA requirements. ENERGY STAR® activities will focus on developing product test procedures and accelerating verification processes. The Energy Efficient Building Systems Design Innovation Hub, initiated in FY 2010, will continue to go beyond advanced research on building components and develop systems models that optimize and integrate components to provide increased energy savings through synergistic functionality.

Federal Energy Management Program (FEMP)

The FY 2011 budget request of $42.3 million allocates an additional $10.3 million (32 percent increase) above FY 2010 appropriated levels to assist Federal Agencies in meeting the requirements of statutory and executive energy conservation goals, including direction provided by Executive Order 13514 to reduce their GHG emissions. FEMP's continued support of agencies' efforts to become more energy efficient, less reliant on nonrenewable energy sources, and decrease water use will help them achieve these goals. FEMP provides assessments, audits, training, rulemaking, coordination, access to alternative private financing, and leadership across the Federal government so it can achieve its legislated and executive mandates. FEMP supports efforts by DOE to meet or exceed all energy and water goals.

Hydrogen and Fuel Cell Technologies

The FY 2011 budget request of $137 million represents a $37 million (21 percent) reduction from the FY 2010 appropriated levels. This request allows a balanced portfolio of transportation solutions and a continued focus on battery and advanced vehicle approaches for more near-term impacts while maintaining a strong effort in key areas of hydrogen and fuel cell R&D. Hydrogen fuel cells provide power that can be cleanly produced from a wide range of abundant domestic energy resources, including renewable resources (such as biofuels and by-products from biomass) and natural gas, which can lead to substantial reductions in CO_2 emissions and petroleum consumption. The program will invest in reducing the cost and improving the durability and performance of fuel cell systems by addressing stack components such as catalysts and membranes, as well as the balance of plant components, degradation, and water transport. The program will also invest in hydrogen fuel R&D, with a goal to reduce the capital cost of hydrogen production from renewable resources by 80 percent by 2015.

Geothermal Technologies Program

The FY 2011 request of $55 million, an increase of $11 million (25 percent) over FY 2010 appropriated levels, focuses on extracting heat from the earth through enhanced geothermal systems (EGS) that could provide up to 100,000 MW of electric power by 2050. Investments support research and demonstrations of EGS technology at different geological field sites to increase reservoir production rates and lifetimes and complement accelerated activities enabled by the Recovery Act.

Industrial Technologies Program

The FY 2011 request of $100 million is a $4 million (4 percent) increase over FY 2010 appropriated levels. It supports a critical expansion of the "Save Energy Now" (SEN) initiative necessary for realizing the program's goal of reducing industrial energy intensity by 25 percent over 10 years through voluntary collaborative partnerships. This goal is inspired by EPAct 2005, which required that each of these partnerships have, as a goal, at least a 2.5 percent per year reduction in energy intensity during the period from 2007 through 2016. Through SEN, 2,421 energy use assessments were completed from 2006 through November 2009, identifying energy cost savings of more than $1.3 billion annually that would also avoid 11.7 million metric tons of carbon dioxide emissions. Additionally, the program will continue to conduct industry-specific and crosscutting RD&D activities, ranging from ultra-high efficiency boiler systems to innovative low-energy chemical membrane systems and the development of cutting-edge nanotechnologies. Another major program focus will be the development of energy-efficient combined heat and power systems. The Manufacturing Energy Systems subprogram will be initiated to serve as knowledge development and dissemination centers organized around distinct manufacturing areas with critical technical needs.

REgaining our ENERGY Science and Engineering Edge (RE-ENERGYSE)

DOE requests $50 million for RE-ENERGYSE through EERE. An additional $5 million for RE-ENERGYSE is included in the DOE Office of Nuclear Energy's FY 2011 request. This program will focus on creating a highly skilled U.S. workforce dedicated to developing and implementing advanced energy technologies, processes, and systems that can help the U.S. accelerate its transition to a low carbon economy. Through a competitive process, this program will provide fellowships, internships, and other hands-on research opportunities for undergraduate, graduate, and post-doctoral students focusing on clean energy and innovative new energy systems. The program will also support the development of interdisciplinary professional masters programs in advanced energy systems and management. RE-ENERGYSE will also dedicate resources to technical training to equip workers with the skills needed to enter clean energy jobs in the near-term, as well as for K-12 students to ensure a pipeline of inspired and well-educated individuals prepared to solve our Nation's greatest energy and climate change challenges. Included in the EERE request for RE-ENERGYSE is $5 million for the DOE-sponsored Solar Decathlon which joins 20 college and university teams in a competition biannually to design, build, and operate the most attractive and energy-efficient solar-powered house. EERE proposes to move funding for this event from the Building Technologies Program budget line.

Solar Energy

DOE's FY 2011 request of $302.4 million represents an additional $55.4 million (22 percent) over the FY 2010 appropriation to enable the U.S. to compete in the global marketplace with cost-competitive solar energy by 2015. The photovoltaic (PV) subprogram is advancing module and system manufacturing technologies to achieve higher performance and lower-cost products with faster throughput and continuing reliability research to increase the lifetime of PV components and systems, and prove the bankability of new PV technologies. The Concentrated Solar Power (CSP) subprogram is developing low-cost systems with thermal storage to compete in the intermediate and baseload power markets, assisting industry deployment by identifying land environmentally suitable for utility-scale solar projects, addressing issues related to water consumption and transmission, and launching a demonstration of new CSP technologies that could lead to over one gigawatt of projects. The Systems Integration subprogram addresses the technical barriers to wide scale deployment of solar technologies by modeling performance and analyzing effects on the grid, developing new technologies that connect with the smart grid, testing field systems, measuring the solar resource to assess variability, and developing and implementing codes and standards. The Market Transformation subprogram is reducing installed cost and increasing market penetration of solar technologies by training solar installers, and providing information and technical assistance to key stakeholders such as States, utilities, and local governments on how to develop policies and business models that accelerate adoption of solar energy.

Vehicle Technologies

The FY 2011 budget request of $325.3 million, a $14 million (4.5 percent) increase over FY 2010 appropriated levels, significantly increases the emphasis on technologies facilitating cost effective plug-in hybrid electric vehicles (PHEVs), and deployment activities to develop infrastructure for transportation electrification. PHEVs will reduce oil use beyond standard hybrid configurations by enabling electricity to become a significant transportation fuel. PHEVs can operate in electric-only mode for up to 40 miles—meeting the needs of most drivers for commuting and short distance driving. Operating in an electric mode produces no tail-pipe emissions and consumes no petroleum. Vehicle Technologies also conducts R&D on strong light-weight body and chassis materials, advanced combustion, and fuels.

Water Power

The FY 2011 request is $40.5 million, a $9.5 million (19 percent) decrease from FY 2010. The requested amount is sufficient to continue and build upon activities started in FY 2010, as well as to begin to support the development of cost-effective incremental hydropower opportunities identified in 2010. FY 2011 is a critical year for the Water Power program to test marine and hydrokinetic (MHK) devices and identify clean generation opportunities at hydroelectric facilities and dams not currently producing electricity. The program plans to invest up to $10 million in public-private partnerships for the development and testing of innovative device designs to support establishing baseline costs of energy and performance for different MHK technologies. The program's main conventional hydropower investment in FY 2011 will enable increased generation and deployment of innovative water technologies within existing private and public hydropower facilities and at non-powered dams.

Wind Energy

The FY 2011 budget request of $122.5 million is a $42.5 million (53 percent) increase over FY 2010. It includes up to $49 million to "jump start" the domestic offshore wind industry and to ensure that U.S. manufacturing and engineering firms achieve a position of global leadership in that industry. In FY 2011, the program will work to mitigate the barriers that have thwarted U.S. offshore development to date, which can be overcome through a concerted national effort with technical leadership from DOE. DOE will support demonstration activities to reduce the environmental, technical, regulatory, and public acceptance risks of offshore wind deployment, as well as R&D of wind resource prediction tools, load modeling, and other technical tasks which facilitate domestic manufacturing and deployment. The program will continue its detailed testing and analysis of wind turbine drivetrains and blades to improve reliability, manufacturing processes and materials, aerodynamics, and aeroacoustics.

Weatherization and Intergovernmental Program Activities

The Weatherization and Intergovernmental Program's FY 2011 budget request is $385 million, a $115 million (43 percent) increase above FY 2010. The request will continue to accelerate sustainable energy integration and clean energy deployment in partnership with States, U.S. Territories, the District of Columbia, and Native American tribal governments. The State Energy Program supports the expanding State role in utility, renewable energy, building code policies, and other high impact energy projects. Tribal Energy Activities support feasibility assessments, planning, and implementation of clean energy projects on Tribal lands. The Weatherization Assistance Program, through a State-managed network of local weatherization providers, supports home energy retrofits for low-income families and career development opportunities for workers. At a time of economic stress, the program has provided assistance to some of the most poverty stricken portions of our population.

Facilities and Infrastructure

The Facilities and Infrastructure FY 2011 budget request is $57.5 million, an increase of $38.5 million (203 percent) over FY 2010. This line item supports operations and maintenance for the National Renewable Energy Laboratory (NREL), a single-purpose laboratory dedicated to R&D for energy efficiency, renewable energy, and related technologies. Sponsored by EERE as a Federally-funded research and development center, NREL provides EERE, as well as DOE's Office of Science and the Office of Electricity Delivery and Energy Reliability, with world-class R&D, expert advice, and objective programmatic counsel. The NREL complex is currently home to 1,850 researchers, engineers, analysts, and administrative staff, plus visiting professionals, graduate students, and interns on a 632-acre campus located at three major sites in or near Golden, Colorado. The request includes $38.5 million to pay for the construction of the Energy Systems Integration Facility (ESIF). The 130,000-square-foot building, to be located southeast of the existing Science & Technology Facility, will house a variety of research that aims to overcome technical barriers to adding new renewable energy generation systems to the electrical grid. As planned, the ESIF will be a multi-story building that will provide laboratory and office space for approximately 200-250 NREL researchers and support staff.

Program Direction

The FY 2011 budget request for Program Direction totals $200 million, an increase of $60 million (43 percent) above the FY 2010 appropriation. This increase is intended to allow the Office to more effectively manage its programs and projects in support of National energy security and carbon reduction goals. Recent increases in funding provided by Congress to help address these goals have led to corresponding increases in the workload associated with programs, contracts, grants, cooperative agreements, and administrative activities which present significant implementation and oversight challenges for DOE. EERE recognizes the need to ramp up its Federal workforce and contract support services to effectively administer its expanded programs, accelerate the pace at which activities are implemented, and respond to demands for technical assistance, oversight, transparency, and accountability. The requested staffing level provides sufficient Federal employees and support services to execute both regular appropriations and residual Recovery Act activities.

Program Support

The FY 2011 budget request for Program Support totals $87.3 million, an increase of $42.3 million (94 percent) over FY 2010. The requested Program Support funds will cover essential cross-cutting activities, including commercialization, to increase speed and scale of market penetration of EERE technologies. Funds will also support analysis of energy systems and utility policy (efficiency and renewable), evaluate program performance, continue international programs, modernize EERE's use of information technology to make processes and information more accessible, strengthen the peer review process and external reviews of our operations, and other activities.

CONCLUSION

This FY 2011 budget request will help EERE pursue our mission of advancing technologies and related practices to help meet the growing demand for clean, reliable, sustainable, and affordable energy services, and to reduce energy consumption. Full funding for EERE programs will help continue to reduce GHG emissions, generate stable jobs here at home, and enhance our economic and national security by providing additional non-carbon domestic sources of energy.

Mr. Chairman, I appreciate your leadership in providing the resources we need to accomplish our shared goal of creating a clean energy economy. I would be pleased to respond to your questions.

Mr. PASTOR. Dr. Markowsky.

Mr. MARKOWSKY. Mr. Chairman and members of the committee, it is my pleasure to appear before you today to present the Office of Fossil Energy's proposed budget for fiscal year 2011.

The Office of Fossil Energy's primary objective is to ensure that we can continue to rely on clean, affordable, and reliable energy from our traditional fuel sources.

Fossil fuels are anticipated to play an important role in meeting our national energy needs in the future. FE is also involved in America's readiness to respond to short-term crude oil supply disruptions. The fiscal year 2011 budget request of $760.4 million for fossil energy programs will allow us to meet those objectives. This is a reduction of about $191 million. It breaks down to $586.6 million for fossil research and development, $138.9 million for Strategic Petroleum Reserve, $11.3 million for the Northeast Home Heating Oil Reserve, and $23.6 million for the Naval Petroleum Reserve.

The central component of our R &D program is our coal program. In fiscal year 2011 we are requesting $403.9 million, which is essentially equal to the fiscal year 2010. Also, we have $3.4 billion for CCS through the Recovery Act, in addition to $600 million that we have carried over from our Clean Coal Power Initiative.

In our coal program we have four key objectives: develop technologies for globally competitive CO_2 capture for power plants and industrial sources; establish the basis for long-term geological storage and CO_2 reuse; improve efficiency of both existing and new power-generation facilities; and implement computer modeling and simulation to accelerate the RD&D pathway from discovery to commercialization and cost maturity. Our goal: to develop a spectrum of technologies to evolve coal into a low-carbon energy source that is economical and competitive in 2020 and beyond.

We are mainly focusing on coal now—which provides about half of all electricity generation, but natural gas is the second largest source—it will play an increasing role as a backup for intermittent renewables like wind, and also for fuel switching. So CCS will be required initially on coal-fired facilities and eventually on gas-fired systems as we meet our goals of 80 percent CO_2 reduction by 2050.

Required to do this is a range of technologies for capturing and storing CO_2 in a variety of geological formations that also benefit reuse such as enhanced oil recovery.

We are currently pursuing large-scale demonstration of first-generation CCS technologies for coal power generation and industrial sources. These include postcombustion capture and precombustion capture. We envision having eight to ten large-scale CCS demonstration plants in operation between 2014 and 2016, but the cost of these first-generation technologies are high. To drive down the cost of CCS, we are pursuing R&D to increase both the power plant efficiency and develop advanced second-generation technology, envisioning a new round of advanced CCS demonstrations later in this decade with deployment of advanced technologies in a post-2020 time frame. These are the second-generation integrated gasification combined cycle, which will result in about 5 percentage points efficiency advantage over what the current IGCC would capture. This will result in about one-third of the cost penalty that we currently exhibit in first-generation technologies.

Also super-critical steam cycle for polarized coal-fired plants, an advantage of about 3 percentage points, with a cost penalty of only a third of that of the first-generation super-critical plants.

Oxycombustion, a new technology having a cost penalty approximately a third to a quarter of those of conventional polarized coal plants with postcombustion capture.

Supporting these activities will be advanced computer modeling and simulation of energy systems that will reduce the time of bench skills to commercialization.

On the storage side, pursuing carbon sequestration programs to establish a sound, scientific, and technical basis for safe, long-term geological storage; establish best practices for injection and monitoring; help establish technical basis for regulatory framework for carbon storage, and thereby help ensure public acceptance, which is the critical aspect.

For fiscal year 2011, we are requesting $143 million, a reduction of about $11 million in these activities, but it does not affect our storage activities.

This is an industry-government partnership. We are working with our seven regional carbon sequestration partners to address the technical hurdles for carbon storage. It is about a 40 percent cost share by industry.

Our regional partnerships are now involved in nine CO_2 injection sites across the country. For fiscal year 2011, several sites will be injecting CO_2 for large-volume geological storage tests, upwards of a million tons per year. Our Cranfield site in Mississippi currently has achieved 1.5 million tons injection to date.

In the end, the net effect of our CCS activities will allow for coal to continue to be a competitive part of our Nation's diversified low-carbon energy portfolio.

Changing now to the Strategic Petroleum Reserve which provides a stockpile of petroleum to protect the U.S. against disruptions of our critical oil supply. In fiscal year 2011, we are requesting $138.9 million, which is a decrease of $105 million. This decrease assumes a one-time reprogramming of $71 million for cancellation of a 1 million barrel expansion of the facility. So that $138.9 and the $71 will fund the $209.9 million required for the operation and maintenance of our SPR facilities. The other $34 million reduction is due to the cavern that we are purchasing this year for refurbishment in the coming year.

SPR is currently filled to capacity; 727 million barrels currently providing 75 days of U.S. petroleum for protection. Also in 2011, we are pursuing the cavern replacement project at Bayou Choctaw.

Changing now to the Northeast Home Heating Oil Reserve. In fiscal year 2011, we are requesting $11.3 for that. And also in our Natural Gas Program, we are requesting no funding. On methane hydrates we will be continuing to cooperate with the Office of Science.

In conclusion, Mr. Chairman, we look forward to working with this committee on trying to achieve our objectives here. I would be happy to answer any questions you have. Thank you.

Mr. PASTOR. Thank you very much.

[The information follows:]

Statement by Dr. James J. Markowsky
Assistant Secretary for Fossil Energy
U.S. Department of Energy

FY 2011 Appropriations Hearing
House Committee on Appropriations
Subcommittee on Energy and Water Development

March 17, 2010

Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee, it is my pleasure to appear before you today to present the Office of Fossil Energy's (FE) proposed Budget for Fiscal Year 2011 (FY 2011).

The Office of Fossil Energy's primary objective is to ensure that we can continue to utilize our traditional fuel sources for clean, affordable, reliable energy. Fossil fuels are anticipated to play a critical role in meeting our Nation's future energy needs. Making use of the Nation's fossil fuel assets in an environmentally responsible manner will help the United States to meet its energy requirements, minimize detrimental environmental impacts, positively contribute to energy security and compete in the global marketplace.

First and foremost, FE's research and development (R&D) program supports the U.S. Department of Energy's (DOE) overall mission to achieve national energy security in an economic and environmentally sound manner. In the Coal Program, there are four key priorities: 1) developing technologies for globally competitive carbon dioxide (CO_2) capture for power plants and industrial sources, 2) establishing the basis for long-term geologic storage and CO_2 reuse, 3) improving the efficiency of both existing and new coal-fired power generation plants, and 4) implementing computer modeling and simulation to accelerate the R&D path from discovery to commercialization and reduce costs.

Currently, we are pursuing the demonstration of first generation carbon capture and storage (CCS) technologies with existing and new power plants and industrial facilities using a range of capture technologies and storing CO_2 in a variety of geologic formations, including enhanced oil recovery. The goal is to have five to ten large-scale demonstrations in operation by 2016. In parallel, to drive down the high costs of CCS, the FE Coal Program is pursuing R&D to increase base power plant efficiency and thereby reduce the carbon emissions intensity of fossil energy systems. FE is developing a spectrum of technologies to evolve coal into a low-carbon energy source that is economically competitive in 2020 and beyond.

I would note that both President Obama and Congress previously emphasized their support for CCS by investing $3.4 billion in the technology and related programs through the American Recovery and Reinvestment Act (ARRA). These appropriations are currently helping fund activities targeted at expanding and accelerating deployment of CCS technology.

FE also manages the Nation's 727-million-barrel U.S. Strategic Petroleum Reserve that serves as the largest stockpile of government-owned emergency crude oil in the world.

The SPR is vital to ensuring U.S. energy security. This stockpile of crude oil provides energy and economic security against foreign or domestic disruptions in U.S. critical oil supplies and also allows the United States to meet part of its International Energy Agency obligation to maintain emergency oil stocks. In addition, FE oversees the Northeast Home Heating Oil Reserve and the Naval Petroleum Reserves.

Fiscal Year 2011 Budget Request

DOE is requesting $760.4 million for FE programs in FY 2011. Included in this budget are $586.6 million for FE Research and Development; $138.9 million for the Strategic Petroleum Reserve; $11.3 million for the Northeast Home Heating Oil Reserve; and $23.6 million for the Naval Petroleum Reserves.

The FY 2011 budget request will allow FE to fulfill the mission I just outlined: to provide the nation with the best opportunity to tap the full potential of its abundant fossil energy resources in an environmentally sound and affordable manner; and to ensure America's readiness to respond to short-term energy supply disruptions.

Fossil Energy R&D

Our nation has rich deposits of coal, oil and natural gas. We have more energy in our domestic coal reserves, for example, than the rest of the world has in its recoverable oil. Our nation has rich deposits of coal, oil, and natural gas. We have more energy in our domestic coal reserves, for example, than the rest of the world has in its recoverable oil. Our natural gas deposits are extensive with an estimated 40 percent increase in potential resources realized over the past 2 years, or roughly a 90 year supply at current rates of consumption.

The FE Research and Development FY 2011 budget request of $586.6 million represents more than 75 percent of FE's total FY 2011 budget request. It is comprised of several R&D programs designed to advance our ability to use the nation's abundant fossil resources in an environmentally benign way that avoids environmental damage, including greenhouse gas emissions, and benefits our economy for years to come.

($ in Thousands)	**FY 2010 Final Appropriation**	**FY 2011 Budget Request**	**% Change**
Fossil Energy R&D	$672,383	$586,583	-13%

As part of R&D, the FY 2011 budget request for FE's Fuels and Power Systems program is $403.9 million. Initiatives will focus on research, development and deployment of technologies to use fossil fuels more cleanly and efficiently at large power and industrial facilities. The core research and development efforts of the Fuels and Power Systems program focus on: the creation of a portfolio of technologies that can capture and permanently store carbon dioxide from power plants and industrial processes; carbon capture from existing coal-fired power plants; efficiency improvements for existing and new power generation, such as: improved gasification technologies, development of stationary power fuel cells, advanced materials for plant efficiency improvement, and coal-to-hydrogen conversion and improved turbines for future coal-based combined cycle plants.

The Fuels and Power Systems program supports technologies that can then be tested for commercial readiness in our carbon capture and storage demonstration program including the Clean Coal Power Initiative (CCPI).

($ in Thousands)	FY 2010 Final Appropriation	FY 2011 Budget Request	% Change
Fuels & Power Systems R&D	$404,000	$403,850	0%

Carbon Storage. The Department's Sequestration Program focuses on the key technology challenges that confront the wide-scale industrial deployment of CCS. These challenges are being addressed through industry/government cooperative research on cost-effective capture technologies; monitoring, verification, and accounting technologies to assess permanence of storage; permitting issues; liability issues; public outreach; and infrastructure needs. The Department of Energy is requesting $143.0 million for FE's Carbon Sequestration program. Developing low-cost pre-combustion capture technologies and establishing the technical basis for carbon sequestration will lead to a decrease in the atmospheric release of CO_2, thus allowing us to use our domestic fossil fuel resources responsibly by reducing their impacts on global climate change.

Essential to these objectives are the Regional Carbon Sequestration Partnerships (RCSPs). The Partnerships are a central piece of our CCS research efforts with the goal of developing the knowledge base and infrastructure for the wide-scale deployment of geologic storage technologies. The Partnerships are addressing key infrastructure issues related to permitting, pore space (underground reservoir) ownership, site access, liability, public outreach, and education. The Partnerships are also conducting field tests across the United States where these tests reflect the geographic differences in fossil fuel use, potential storage sites and different regional approaches in addressing CCS. The Partnerships encompass essentially all the geologic storage sites in the country that can potentially be available for carbon sequestration. The Regional Partnerships represent more than 350 unique organizations in 43 States, three Native American Indian Nations, and four Canadian Provinces.

In FY 2011, several of the nine large-scale RCSP CO_2 injection projects are scheduled to begin injecting CO_2 for large volume (1 million tons/year) geologic storage tests. Most of the large-scale field tests will have completed the first stage of the projects consisting of site selection and characterization, NEPA, pre-injection monitoring, and permitting. One project will have concluded its injection of 1.5 million tons of CO_2 by FY 2011 and will be conducting post injection monitoring at the site. These large-volume injections are needed to demonstrate that the formations selected for storage have the capability and capacity to store CO_2 from coal-based energy systems.

Innovations for Existing Plants (IEP). The FY 2011 budget request for the IEP program is $65.0 million. The IEP program is focused on developing post-combustion CO_2 retrofit capture technologies. The FY 2011 request represents a $13.0 million increase over FY 2010 to continue work initiated under an FY 2010 Funding Opportunity Announcement for bench-scale and slipstream development and testing of advanced post-combustion CO_2 capture technologies. Research initiated under an FY 2008 FOA directed at laboratory and bench-scale research in the areas of oxy-combustion, membranes, advanced solvents and sorbents and chemical looping will also continue.

Advanced Integrated Gasification Combined Cycle (IGCC). Advanced IGCC technology utilizes a pre-combustion pathway to convert coal or other carbon-containing feedstocks into synthesis gas, a mixture composed primarily of carbon monoxide and hydrogen used as fuel for power generation. The Department is developing advanced gasification technologies to meet the most stringent environmental regulations and facilitate the efficient capture of CO_2 for subsequent sequestration. Gasification plants are complex systems that rely on a large number of interconnected processes and technologies. Advances in the current state-of-the-art, as well as development of novel approaches, are required to make these systems affordable and reliable for commercial deployment. The Department is requesting $55.0 million in FY 2011 for the IGCC program. The program continues to focus on developing the next generation technology in gasification systems related to fuel flexible gasifiers, coal feed systems, high temperature clean-up, and revolutionary oxygen supply technology. These combined developments will significantly reduce the cost of future systems, improve their reliability, and facilitate smooth transition to future systems with carbon capture and storage.

Fuels. The FY 2011 budget request for the Fuels program is $12.0 million. The Fuels Program is focused on reducing technological market barriers for the reliable, efficient, and environmentally friendly conversion of coal to hydrogen with CCS for stationary applications. Efforts for hydrogen production will focus on generation at the plant for large-scale, central power applications, and not transportation. In FY 2011, activities include support for the bench-scale development of hydrogen separation technologies and components.

Fuel Cells. Fuel cells systems when coupled with coal gasification for large scale power generation hold great potential for leapfrog advances in efficiency. Fuel cells also produce very low emissions and are modular in nature so that can be scaled to almost any size deployment need. The ultimate goal of the program is the development of low-cost large (>100 MW) fuel cell power systems that will produce affordable, efficient, and environmentally friendly electrical power from coal with very high efficiency, including integrated coal gasification and carbon dioxide separation processes and capture at least 90 percent of the CO_2 emissions from the system. The program is driving to reduce the cost of large scale fuel cell by an order of magnitude compared to current technology. The FY 2011 budget request for the Fuel Cells program is $50.0 million. The Fuel Cells Program will continue to increase reliability of the Solid State Energy Conversion Alliance, or SECA, fuel cell technology and provide the technology base to permit continued improvement to low-cost fuel cells scalable to MW class ultra-clean systems with potential for up to 60 percent electrical efficiency for central power generation.

Advanced Turbines. The Advanced Turbine Program consists of a portfolio of laboratory and field research and development projects focused on performance-improvement technologies with great potential for increasing efficiency and reducing emissions and costs in coal-based applications. Future gasification based power systems outfitted with carbon capture and storage will require high efficiency hydrogen turbines. Hence, the current focus of the Advanced Turbine Program is the combustion of pure hydrogen fuels in MW-scale turbines greater than 100 MW size range and the compression of large volumes of CO_2. In FY 2011, the Advanced Turbines program aims to continue improving the firing temperature and throughput for the next generation of combustion turbines for coal-based integrated gasification combined cycle power systems that capture and sequester CO_2. The Department is requesting $31.0 million for this activity in FY 2011.

Advanced Research. The Advanced Research Program is a bridge between basic research and the development and deployment of innovative systems capable of creating highly efficient and environmentally benign electricity and power. The objective of the program is to support development of critical enabling components that provide cross cutting benefits across the entire coal research program. Example developments that are being pursued include high-temperature materials, revolutionary sensors and controls, and advanced computing/visualization techniques. The proposed $47.9 million FY2011 budget will continue to push revolutionary advances in efficiency improvements, computational analyses and projects aimed at a greater understanding of the physical, chemical, and thermo-dynamic barriers that currently limit the use of coal and other fossil fuels.

Additionally in FY 2011, a multi-lab partnership will be initiated to develop a comprehensive, integrated suite of computational models for accelerating the development of carbon capture technologies. The scientific underpinnings of the suite of models will ensure that learning from successive generations of a technology or learning from even competing technologies is maximized. The simulation-based confidence will reduce the risk in incorporating multiple innovative technologies into a new plant design, thereby significantly reducing the development cycle required to move novel technologies to commercialization.

Clean Coal Power Initiative. The 2011 Budget maintains the 2010 funding level for R&D, but does not request any demonstration funds because these projects are already strongly supported through the American Recovery and Reinvestment Act (ARRA). ARRA provided $3.4 billion for CCS, of which $800 million will support CCPI demonstration projects, increasing the total available funding for CCPI round 3 to roughly $1.4 billion. In FY 2011, FE will focus on project execution in all Rounds of CCPI, and completion of National Environmental Policy Act procedures for ongoing projects.

Tapping the Nation's Unconventional Oil and Gas Resources

FE's Natural Gas Technologies and Oil Technology programs have focused on science and technology to find and produce oil and gas from non-conventional reservoirs and reduce the environmental impact of resource development.

Natural Gas Technologies. In FY 2011, the Office of Basic Energy Sciences within the Office of Science will initiate a new research program in gas hydrates. Therefore, no funding is requested in the FE budget.

Petroleum – Oil Technology. No funding is requested for the Oil Technology program in FY 2011.

($ in Thousands)	**FY 2010 Final Appropriation**	**FY 2011 Budget Request**	**% Change**
Natural Gas Technologies R&D	$17,833	$0	-100%
Unconventional Fossil Energy Technologies	$20,000	$0	-100%
Petroleum R&D	$0	$0	0%

Petroleum Reserves

The Office of Petroleum Reserves manages the Strategic Petroleum Reserve and Northeast Home Heating Oil Reserve programs, which provide critical protection to the Nation and the public against economic damages from potential disruptions in foreign and domestic petroleum supplies; and the Naval Petroleum and Oil Shale Reserves, involving the Department's environmental legacy responsibilities from the sale of the Naval Petroleum Reserve No. 1 (NPR-1) in California and the operation of the NPR-3 stripper oil field and Rocky Mountain Oilfield Testing Center, both located near Casper, Wyoming.

Strategic Petroleum Reserve. The Strategic Petroleum Reserve (SPR) provides strategic and economic security against disruptions in oil supplies with an emergency stockpile of crude oil. The SPR is currently filled to capacity at 727 million barrels, which provides 75 days of U.S. petroleum import protection.

The FY 2011 budget request of $138.9 million for SPR is a decrease from FY 2010 funding. The decrease assumes a one-time cancellation of $71 million in balances from prior year appropriations for a 1 billion barrel expansion at the Richton, MS site and the use of these balances to partially fund the $209.9 million operations and management activities of the SPR.

FY 2011 budget includes funding for the SPR's cavern replacement project which is required to eliminate current environmental risks. The funds will provide for activities associated with the integration of a new storage cavern into site infrastructure at the Bayou Choctaw site.

Additionally, FY 2011 provides for the assessment of energy efficiency and greenhouse gas (GHG) control at SPR facilities toward meeting the DOE goal to lower GHG emissions at all DOE facilities. The SPR budget request will continue vapor pressure mitigation activities to ensure the availability of crude oil inventories at SPR sites within environmental and safety constraints and includes funding needed to move a degas plant to the West Hackberry site beginning in FY 2011.

Northeast Home Heating Oil Reserve. The Northeast heating oil reserve, which was established in 2000, is capable of assuring a short-term supplement to private home heating oil supplies in the event of a supply disruption or shortage in the northeast region. The two million barrel Reserve protects the Northeast against a supply disruption for up to 10 days, the time required for ships to carry heating oil from the Gulf of Mexico to New York Harbor.

The FY 2011 budget request of $11.3 million will fund continuing operation of the Reserve with the lease of commercial storage space, and provides funding for the award of new storage contracts in late FY 2011.

Naval Petroleum and Oil Shale Reserves. To date, three of the four original Naval Petroleum Reserves (NPR-1, NPR-2, and NPR-4) have been sold or transferred to the Department of the Interior. The only remaining oil reserve managed by the DOE is the Teapot Dome field (NPR-3) in Casper, WY, which is now a stripper field that also serves as an oilfield technology testing center (Rocky Mountain Oilfield Testing Center).

The FY 2011 budget request for this program is $23.6 million, which will continue to fund the equity finalization and environmental remediation of the former NPR-1 and the production operations for NPR-3. In FY 2011, all fossil energy related research and development at the Rocky Mountain Oilfield Testing Center will be funded through fully reimbursable (funds-in) agreements.

($ in Thousands)	**FY 2010 Final Appropriation**	**FY 2011 Budget Request**	**% Change**
Strategic Petroleum Reserve	$243,823	$138,861	-43%
Northeast Home Heating Oil Reserve	$11,300	$11,300	0%
Naval Petroleum and Oil Shale Reserves	$23,627	$23,614	0%

Conclusion

Our FY 2011 budget request will help maintain DOE's leadership role in addressing the issue of global climate change. FE is committed to developing the science and technology that will allow the nation to use its abundant fossil energy resources in a way that balances the energy needs for sustaining a robust economy with a clean environment. We believe this budget will produce results. The investments we are proposing will help us deliver to the nation: superior electricity generating technologies that give us an affordable way to reduce greenhouse gases, particularly CO_2 emissions; and a fully capable Strategic Petroleum Reserve, Northeast Home Heating Oil Reserve, and Naval Petroleum and Oil Shale Reserves to effectively counter the economic disruptions of an energy emergency.

We look forward to working with this Subcommittee to achieve these goals.

Mr. Chairman, and members of the Committee, this completes my prepared statement. I would be happy to answer any questions you may have at this time.

DOE's Fossil Energy Budget Summary

($ in Thousands)	**FY 2010 Final Appropriation**	**FY 2011 Budget Request**	**% Change**
Coal Technology R&D	$404,000	$403,850	0%
Natural Gas and Unconventional Fossil Energy Technology	$37,833	$0	-100%
Petroleum Reserves	$278,750	$173,775	-38%
Program Direction/Other R&D/Management Support	$230,550	$182,733	-21%
Total, Fossil Energy	**$951,133**	**$760,358**	**-20%**

Mr. PASTOR. Secretary Hoffman.

Ms. HOFFMAN. Thank you, Mr. Chairman and members of the committee. Thank you for the opportunity to appear before you today to discuss the President's fiscal year 2011 budget request for the Office of Electricity Delivery and Energy Reliability, a core component to achieving our goal of building a low-carbon economy and securing the Nation's energy future. As was noted, we also had to squeeze more out of the system that we have today in enabling that future.

The Recovery Act provided $4.5 billion in the Office of Electricity to support strategic investments in a stronger, smarter, more efficient electric infrastructure. The Recovery Act has provided an unprecedented infusion of funds that will enable us to jump-start the modernization of our Nation's electrical grid through increased deployment of smart grid technologies.

Our fiscal year 2011 request continues these modernization efforts by supporting development of next-generation technologies. The President's 2011 request is $185.9 million, which is an 8 percent increase from the 2010 request, and reflects a commitment in energy research and development, transitioning to a clean energy economy.

Specifically, $144.3 million will fund research and development activities, while $6.4 million will continue to support permitting, siting and analysis work that is critical to advancing the development of a modern grid, and $6.2 million will allow us to enhance the reliability, resiliency, and security of our Nation's critical infrastructure and facilitate recovery from energy supply disruptions. The remaining $29 million will provide the Executive Management Program oversight and information required for the effective implementation of these activities.

Highlights of our 2011 request include $40 million for energy storage, which represents a $26 million increase from fiscal year 2010. This increase will support expanded efforts to enable successful integration of renewables into the grid. Large-scale megawatt-level energy storage systems or multiple smaller-scale distributed storage systems have the potential to significantly reduce transmission system congestion, manage peak loads, increasing the overall reliability of the electric grid.

The 2011 request also highlights $10 million for advanced grid modeling research which will enable the Department to partner with universities and industry, focusing on applying new scientific insights into the electric system—for improvements in grid operations—including modeling of resource generation, energy markets and electricity flow.

Ten million dollars is also included to support power electronics that play a pivotal role in improving the reliability, security, and flexibility of the grid. Research efforts will include the development of advanced semiconductive materials and devices for faster switching and power conversion in order to reduce energy disruptions and decrease power costs. This work will focus on wideband semiconductors, advancing promising new materials towards commercialization, working with new universities, material producers, and device manufacturers.

Enhanced cybersecurity to protect against the exploitation of high-risk vulnerabilities in the electrical system is critical to the development of a reliable, resilient, and secure monitoring grid. The fiscal year 2011 request allocates $30 million for cybersecurity to continue initiatives that reduce potential disruptions by cyber attacks.

This concludes my statement, Mr. Chairman. I look forward to answering any questions that you may have.

Mr. PASTOR. Thank you very much.

[The information follows:]

STATEMENT OF
PATRICIA HOFFMAN
PRINCIPAL DEPUTY ASSISTANT SECRETARY
FOR ELECTRICITY DELIVERY AND ENERGY RELIABILITY
U.S. DEPARTMENT OF ENERGY
BEFORE THE
UNITED STATES HOUSE OF REPRESENTATIVES
HOUSE APPROPIATIONS SUBCOMMITTEE ON
ENERGY AND WATER DEVELOPMENT
MARCH 17, 2010
FY 2011 APPROPRIATIONS HEARING

Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's Fiscal Year (FY) 2011 budget request for the Department of Energy's (DOE) Office of Electricity Delivery and Energy Reliability (OE).

Today, the availability and access to electricity is something that most Americans take for granted. It is vital to our economic prosperity and security. It pervades nearly every aspect of our lives from powering our electronics and heating our homes to supporting transportation, finance, food and water systems. Our electrical grid is a critical element of our energy infrastructure, but today it is being asked to provide dynamic response under mounting stresses. It is the mission of this office to lead national efforts to modernize the electricity delivery system, enhance the security and reliability of America's energy infrastructure, and facilitate recovery from disruptions to energy supply, which are vital to achieving Secretary Chu's goal of building a low-carbon economy to secure the Nation's energy future.

Modernizing the Nation's electrical grid through technical innovation, however, represents just one side of our efforts to work towards America's energy independence. Building the elaborate network of wires and other facilities needed to bring energy to consumers reliably and safely is perhaps one of the energy industry's greatest challenges today. This is especially true since renewable energy will become a substantial generation source that will require transformational technologies to enable integration into the electric grid.

Our work today supports energy and climate security through investments in grid modernization to develop critical technology to enable large penetration of renewables, utilizing new technologies in storage, communications and power electronics; advance breakthroughs in electric transmission and distribution technologies; and enhance the security and reliability of the grid amidst the pressures of increasingly aggressive threats. At the same time, we are working with our stakeholders to develop strategies and next-generation technologies that can overcome the challenges facing the Nation's power grid. The FY 2011 budget request of $185.9 million for this program will help put us on the right trajectory to meet these objectives.

The President's FY 2011 budget request of $185.9 million for OE, an 8 percent increase from the FY 2010 request, reflects the commitment in energy research and development to transition to a clean energy economy. Specifically, $144.3 million will fund Research and Development activities, while $6.4 million will continue to support Permitting, Siting and Analysis work that is critical to advancing the development of a modern grid; and $6.2 million will allow us to enhance the reliability, resiliency and security of the Nation's critical infrastructure and facilitate its recovery from energy supply disruptions. The remaining $29.0 million will provide the executive management, program oversight, analysis, and information required for the effective implementation of these activities.

A more detailed explanation of the FY 2011 budget request is provided below. Before moving on to the details of the FY 2011 request, I would like to speak briefly about our progress in implementing the programs funded under the American Recovery and Reinvestment Act and their relationship to the FY 2011 request.

STATUS OF RECOVERY ACT INITIATIVES

The Recovery Act provided $4.5 billion to support strategic investments in a stronger, smarter, more efficient electricity infrastructure. We have allocated more than $4 billion, matched by more than $5.5 billion in private sector funding, to invest in the deployment of Smart Grid technologies to increase efficiency (environmental and economic), increase reliability, and give consumers more choice and control over their energy use.

Our Recovery funds also support other important initiatives, including long-term, coordinated transmission planning within the three interconnections across the country; work with the National Institutes of Standards and Technologies, the development of interoperability standards that will enable smart grid devices to communicate in an efficient and secure way; and workforce development support to community colleges, universities and businesses to build the skilled electric power system workers essential to modernize the grid. The funds also provide assistance to state and local governments to improve planning and emergency preparedness to minimize impacts of energy supply disruptions, and providing additional resources to state public utility commissions to help with the increased workload they face in regulating and overseeing new electricity and energy projects. To date we have announced selections of awardees for all initiatives except workforce development, which we hope to announce by mid-Spring.

The Recovery Act has provided an unprecedented infusion of funds that has enabled us to jumpstart the modernization of the Nation's electrical grid through increased deployment of smart grid technologies, technologies that are currently available but not yet in widespread use. Our FY 2011 request continues modernization efforts by supporting development of the next generation of technologies that can go beyond what can currently be found on the shelf. The activities supported in our budget request through our research and development efforts, ongoing state and regional assistance, and energy restoration activities are distinct from those funded through the Recovery Act, but will continue to build on and learn from the progress that has been made.

RESEARCH AND DEVELOPMENT

OE collaborates with industry, government, universities and the public in the pursuit of technologies that reduce greenhouse gases; and contributes to the Nation's energy independence by improving the reliability, efficiency, flexibility, functionality and security of the electric grid. Our Research and Development (R&D) program is OE's largest program and accounts for almost 75 percent of the FY 2011 request. Our R&D activities support the goal of building a competitive, low-carbon economy by promoting the development of an efficient, "smart" electricity transmission and distribution network. These activities sustain continued development of smart grid technologies, tools and techniques; energy storage systems; and power electronic devices for grid modernization and integration of renewable and clean energy systems.

The FY 2011 budget request of $144 million for the R&D program, an increase of approximately $19 million from FY 2010, supports four program areas: Energy Storage, Clean Energy Transmission and Reliability, Smart Grid Research and Development, and Cyber Security for Energy Delivery Systems.

The FY 2011 request reflects an increased focus on development of transformational technologies and innovative tools that will enable the integration of renewable resources. A clean energy future depends on the development of such renewable resources, but variable and intermittent nature of the resources like solar and wind present a challenge for an electric grid designed for an electricity supply that is relatively fixed.

Our FY 2011 request of $40 million for the Energy Storage program represents almost a tripling or a $26 million increase from FY 2010. The large increase will support expanded efforts to enable successful integration of renewables into the grid. Large grid-scale, megawatt-level energy storage systems, or multiple, smaller distributed storage systems, have the potential to significantly reduce transmission system congestion and manage peak loads, increasing the overall reliability of the electric grid. Storage technologies also facilitate the integration of variable and intermittent renewable energy resources by enabling the storage of electrical energy so that it can be available whenever it's needed. FY 2011 activities include bench-scale and field testing with renewable energy developers, including Compressed Air Energy Storage (CAES) studies for wind applications and advanced batteries for solar uses, as well as feasibility studies for bulk storage systems to support high renewable penetration. Energy storage research in FY 2011 also includes electrochemical and materials research and system-level development, engineering, and analysis, including tools to guide utilities' application. Development of a new outreach program for regulators and non-technical stakeholders will highlight energy storage uses and benefits. OE, with its focus on applied research for the electric grid, works collaboratively across the Department on energy storage research with the

Offices of Science and Energy Efficiency and Renewable Energy, and the Advanced Research Projects Agency - Energy.

The FY 2011 request highlights $10 million for Advanced Modeling Grid Research, an activity within the Clean Energy and Transmission Reliability Program. This initiative will enable the Department to interpret and analyze newly-available, real-time data from the electrical system to anticipate modeling and engineering challenges resulting from grid modernization activities. This research, done in partnership with universities and industry, focuses on applying new scientific insights to electric system data for improvements in grid planning and operations, including modeling of resource generation, energy markets and electricity flow. We anticipate that this research will improve grid reliability through real-time system dynamics, which incorporates the variability of renewable resources and compares actual data to modeling predictions for irregularities in grid operations. In FY 2011, we will competitively solicit projects with universities and national laboratories that focus on the technical challenges and gaps identified by technical experts.

In FY 2011, $10 million is also included to support Power Electronics, which are flow control devices that play a pivotal role in improving the reliability, security and flexibility of the grid. Research efforts will expand in FY 2011 to include development of advanced semi-conductor materials and devices for faster grid switching, flexible power conversion and improved two-way flow control in order to reduce energy disruptions and decrease power costs. This work will focus on wide bandgap semi-conductors, advancing promising new material system toward commercialization, and working with universities, materials producers, device manufacturers, systems providers and utilities.

The FY 2011 request also provides a sustained effort for other research areas. This includes $29 million for Smart Grid Research and Development, which focuses on adapting and integrating the use of digital technologies, tools and techniques to enhance operational intelligence and connectivity to improve the grid's reliability, efficiency and security. Efforts in FY 2011 will focus on four key technology areas—Advanced Control Methods, Improved Interfaces and Decision Support, Advanced Components, and Integrated Communications. Our ongoing R&D work will build on the Smart Grid investments supported by the Recovery Act, which greatly accelerated deployment of smart meters and other elements of smart grid. For example, in FY 2011, we will launch technology development projects that address critical gaps identified in Recovery Act funded demonstration projects and conduct field tests to validate critical communications standards for grid interoperability identified through the National Institutes of Standards and Technologies framework.

This budget request also continues support for development of advanced transmission-based sensors, tools and capabilities. $20 million supports Transmission Reliability and Renewables Integration activities, which are a part of the Clean Energy and Transmission Reliability program. More sophisticated transmission technologies and power system information are essential as the demand for more reliable electricity and the integration of renewable resources grows. Work focuses on providing real-time data to improve electric transmission and distribution planning and operations, including the development of innovative analysis tools for North American wide-area monitoring system (WAMS).

Enhanced cyber security to protect against the exploitation of high-risk vulnerabilities in the electrical system is critical to the development of a reliable, resilient and secure modern grid. The FY 2011 request provides $30 million for Cyber Security for Energy Delivery Systems program (CS-EDS) to continue initiatives that reduce potential energy disruptions by cyber attacks with the development of modeling and simulation capabilities that quickly assess the risk of newly discovered vulnerabilities and cyber attack techniques. CS-EDS works with the energy industry, system vendors, academia and federal agencies to secure energy communications and control systems against cyber attacks by implementing protective measures and response strategies to sustain the grid's cyber security over time. In FY 2011, we will conduct test bed assessments of two control systems typical of those used in the energy sector; continue advanced training courses in control systems security; and develop a prototype for a wide-area routed communication network that provides enhanced security for the smart grid. Our request reflects a $10 million decrease from FY 2010, as several industry-led projects are nearing completion, and no funding for the National Energy Sector Cyber Organization is included.

The FY 2011 request winds down DOE's involvement in high temperature superconductivity research (HTS). After investing over $600 million over the past 20 years, the Department believes that the HTS wire research has reached a point that provides meaningful technical value. This will mark a successful transition of second generation HTS wire technology developed at the DOE National Laboratories to a U.S. manufacturing base. The FY 2011 request includes $5 million in its Cables and Conductors activity to provide for an orderly closeout of OE-sponsored work with its laboratory and industry partners. Ongoing demonstration projects of HTS technologies in grid applications, which include power cables, fault current limiters and transformers, were fully funded under the Recovery Act. These Recovery Act-funded projects will continue to completion through 2014.

PERMITTING, SITING, AND ANALYSIS

With level funding of $6.4 million in FY 2011, we continue to build on efforts to assist States, regional entities, and other federal agencies in developing policies and programs aimed at modernizing the power grid. We expect to see increased requests in FY 2011 from public utility commissioners and other state agencies for technical assistance on electricity policy, focusing on ratepayer-funded energy efficiency and Smart Grid efforts.

We will also continue to coordinate all Federal authorizations for new transmission facility siting and authorize new international transmission lines that provide access to economic sources of electricity from Canada and Mexico. Lastly, we will capitalize on the investment initiated through Recovery Act awards to further expand the assistance to States and regions as they continue interconnection transmission planning efforts and accelerate reviews of electric utility investments in projects such as Smart Grid, energy storage, demand response, renewable energy, energy efficiency and electric and hybrid vehicles.

INFRASTRUCTURE SECURITY AND ENERGY RESTORATION

The request of $6.2 million in FY 2011 continues support of activities to enhance the reliability, resiliency and security of U.S. critical infrastructure and facilitate its recovery from energy supply disruptions. We will improve our situational awareness and response capabilities to power outage and restoration through visualization and modeling tools. In addition, we will complete and maintain a grid monitoring capability with the private sector. Our work will continue in identifying, monitoring and responding to threats and process control systems that may affect the reliable delivery of energy to the Nation, as well as collaborate with industry to identify and implement mitigation solutions. Expanding infrastructure reliability activities continue through a robust system analysis process designed to identify critical assets and key interdependencies within energy systems.

This office has close relationships with the energy infrastructure owners and operators, as well as state and local governments, allowing us to fully understand their perspectives on protection, mitigation, and response options for quick technology deployment in a tailored, systems approach. This places OE in a unique role of defining the technology needs of the energy infrastructure, helping discover potential technical solutions, and facilitating deployment of new technology into the energy sector. Additionally, we will continue our emergency support responsibilities by undertaking preparedness, response, recovery and mitigation activities with other Federal agencies, the States and local governments.

PROGRAM DIRECTION

Our FY 2011 budget request asks for $29 million for Program Direction, which covers the cost of sustaining Federal staff and other services required to provide overall direction, management, and support for OE. The request supports 113 Full Time Equivalents (FTEs) in FY 2011. The funding increase primarily reflects support for an additional 30 FTEs that were funded through the Recovery Act in FY 2010. Although Recovery funds expire at the end of FY 2010, the grants and agreements awarded under the Act will continue for several years. Federal staff provides critical technical project management and monitoring of ongoing Recovery Act grants and agreements.

CONCLUSION

Our work in OE contributes to our Nation's energy health, by facilitating a reliable, efficient, secure and resilient electricity grid. Through our research and development and other efforts, we will work to increase grid efficiency, and enhance the viability of clean energy resources by addressing issues such as intermittency, controllability, and environmental impact.

Federal investment in the research, development, and deployment of new technology combined with innovative policies and infrastructure investment, is essential to improving grid performance and ensuring our energy security, and environmental well-being.

This concludes my statement, Mr. Chairman. I look forward to answering any questions you and your colleagues may have.

Mr. PASTOR. Due to the four people on the panel and the interest we have with the attendance, we will adhere to the 5 minutes—that is in asking the question and getting the response—so we can have everybody participate. There are many questions to be asked and answered, so I will start very quickly.

Recovery Act. Since your programs received a large amount of money as compared to your usual annual budget, there is concern in two areas that I would like for you to highlight.

One is oversight. What have you done to ensure oversight, that these programs are being used as they should be, and to minimize fraud, abuse, et cetera?

And then, second, the benefit of these projects in terms of, to date, what jobs have been created? And then what do you see happening in the future as we transform our economy?

Ms. JOHNSON. Thank you, Mr. Chairman.

I would like to respond and then turn it over to the Assistant Secretaries to add further information as required or requested by the committee.

Let me just start out by saying our budget for fiscal year 2011 request is $10.45 billion, a 1.7% decrease over the $10.6 billion from FY 2010. To put that into context, the Recovery Act, as you noted earlier, is $36.7 billion. Of that, we have obligated $25.9 billion, we have contracted nearly $10 billion, and we have reimbursed $2.8 billion. So the government doesn't pay until the work gets done, completed, and we get billed.

So let me take the benefit first. In terms of jobs, the Federal Reporting Government Web site shows 16,000 jobs for the quarter ending December 2009; another 4,000 jobs reported by contractors; and 12,633 self-reported jobs from the 1603 Grants in lieu of Tax Credits. So at the moment we have about 32,000 jobs created just in the quarter ending with December of 2009.

Many more benefits I could go into, but I am mindful of the time. Let me get to the oversight because I understand that that is a concern, and I would like to address that.

We recognize that this was a huge budget increase, and therefore we brought in the inspector general earlier. They put out a document in March 2009. We are looking at doing preventive audits early in order to highlight areas where we are vulnerable.

So with regard to waste, fraud and abuse, we have visited 16 of the high-risk States before deploying funds. For each program in the weatherization, SEP and the EECBG, we have account officers that are providing oversight. They are executing site visits on a quarterly basis as opposed to every 2 years, which was done in the past.

On the competitive grant side, the Assistant Secretaries, Matt Rogers who is head of the Recovery Act, and myself, reviewed the credentials of every single reviewer that helped us make decisions on those grants, and we received a full and detailed briefing on every single selection.

The oversight, I believe, has been unprecedented and we are going to continue and follow up to limit the fraud, abuse and waste in the program.

Mr. PASTOR. Secretary Zoi.

Ms. ZOI. If I might, just because I think it is a good scene setter for other questions, I can give you a stock take or an update on what is happening with the Weatherization Assistance Program, which is a $5 billion program, and the State Energy Program, because I think it is illustrative.

The Recovery Act didn't double the weatherization program or triple it. It increased twenty-five times, so this is an of exercise of enormous scale. And we also had Davis-Bacon provisions to deal with.

What we have been able to do in the last quarter of last year was triple the number of homes weatherized. In order to get to the Administration's target of 600,000 low-income people's homes being weatherized, we have to get to a rate of about 20,000 to 30,000 a month, depending on the dollars spent per home. In February, we estimate we were somewhere between 16,000 and 18,000. So we think that we have turned a corner. Every single State and every single community action agency has known production targets for how many low-income people's homes they need to get in there and retrofit, and we have made enormous progress.

The months in the summer and the fall were spent training new people, hiring new people, building new infrastructure, and acquiring new infrastructure. We are now out in the field delivering the benefits that the program was designed to deliver. So that is actually a very good story now.

The State Energy Program is a $3.2 billion formula grant program where every State and territory is getting financial assistance to create clean energy initiatives. We are now at a point where 30 percent of that money is under contract at the State level. It has all been obligated to the States. The process is the States then do competitions and solicitations on their own to identify how that money can be spent well and wisely. Thirty percent of it is now under contract.

What you don't see in the costing numbers is that—the money won't show up in costed accounts unless those invoices come into the State level, and then the States then ask us to pay them back. So inherently there is going to be a lag time with the amount of money that is spent, but jobs have already been created and they are out there in the marketplace.

Mr. PASTOR. Thank you.

Mr. Frelinghuysen.

Mr. FRELINGHUYSEN. Well, let's talk about the jobs. What kind of jobs are they? How many are private sector jobs and how many of them are government jobs? I guess most of the State energy money is out there, it has been obligated, but very little of it has been spent; is that right?

Ms. ZOI. Right. But a third of it now, roughly, is under contract, which means that there are private sector entities that are doing work retrofitting libraries or public buildings, and so that work is underway. So that is probably going to be a combination. It is probably going to be mostly private sector companies that are doing these jobs.

Mr. FRELINGHUYSEN. So how many people are the States hiring to run these programs?

Ms. ZOI. For the programs in EERE, about 10,500 jobs have been created so far.

Mr. FRELINGHUYSEN. I would like to get the distinction between private sector jobs and government jobs. I mean, I know there was a goal in the overall stimulus bill for 600,000 public sector jobs. I don't want to beat up on the public sector, but in reality most of our constituents are interested, actually, in what the stimulus is doing to sort of promote private sector jobs.

Ms. JOHNSON. Understood. Let me comment on that.

Mr. FRELINGHUYSEN. Having served in the State legislature, at least in my State, I am not against hiring a whole pile of people in New Jersey. But in reality, I think most people would like to sort of get a piece of the action in the private sector.

And I have to say that, just from personal experience, the people who do the type of work in my State, I mean, it is a little above mom and pop. Many of these groups have no track record at all with dealing with these types of financial obligations, for which a lot of money has been put out there. Even your IG has raised some prospects about—I hate that term "waste, fraud and abuse," but some of what we are talking about here is overwhelming amounts of money being given to, shall we say, community groups that have a pretty miserable track record. So how would you judge where this money is going and how many private sector jobs are connected to it?

Ms. JOHNSON. Let me address the private versus public. And we also will get back to you for the record if our response is not complete for your satisfaction, and then I will turn it back over to Assistant Secretary Zoi for addressing the community action agencies.

So of the 16,300 FTEs that are reported on the Federal Reporting.gov, the large majority of those are private sector. Four thousand created are subcontracts, definitely private sector. And the 12,633 self-reporting from the 1603 Grants in Lieu of Tax Credits for the clean energy economy, are private sector.

And of those, if I may just clarify, that is approximately 30,000 new jobs or jobs saved for the quarter. We will see more jobs created as we finish the obligation of the grants in the fossil areas, as well as the smart grid investment grant. And we anticipate being able to fulfill our commitment to 600,000 jobs generated with the $36.7 billion that we have been given responsibility for.

Mr. FRELINGHUYSEN. Part of our concern—at least I will voice my concern—is that we gin up all these operations, give them a considerable amount of money and responsibility—and I am sure that you will make sure that they will account for every damn penny that they get. Then when the stimulus money runs out—and at the rate it has been obligated in terms of outlays, at some point in time a lot of what you have ginned up is going to have to—what is going to happen after that? What is plan B?

Ms. JOHNSON. So in response to that, a couple of things. We have invested $4.5 billion in small businesses. As you know, in the last 20 years, 94 percent of the new jobs in this country have been created by small businesses. Some of those small businesses have the opportunity and have demonstrated the potential to do what I call job amplification. Let me give you an example. A123 Batteries in

Massachusetts, they started out in 2001 with an SBIR grant of $150,000.

Mr. FRELINGHUYSEN. Are these fuel cell?

Ms. JOHNSON. Electric batteries. They grew to 1,700 employees, went public, brought off the sidelines a half a billion dollars in private investment. These are the kind of opportunities that we are investing in.

Mr. FRELINGHUYSEN. I know we are part of the overall financial equation, but when we withdraw this largesse, there is obviously going to be some economic reaction.

Ms. JOHNSON. You bet. And in response to that, I will turn it over to Assistant Secretary Cathy Zoi to talk about why there is an increase in our weatherization base program of fiscal year 2011, because we recognize what you are saying. We want to keep the momentum going and continue to accelerate the opportunities for the community action agencies that have had to scale up.

I have visited North Carolina, I have visited Texas, I have gone to Seattle and Indianapolis. I have talked to people in the areas where we are training and monitoring, and working to develop the capability in the community action agencies at the State level, in order to accelerate our ability to retrofit and weatherize homes. But Cathy, maybe you would like to add something to that.

Mr. PASTOR. I will let you take 1 minute.

Ms. ZOI. Just going back to the President's and the administration's objectives, what we are trying to do is catalyze a clean energy transformation and invest in the economy in ways that we can receive a great deal of leverage and stand up whole sectors. So, for example, in the weatherization front, the same workers that are being hired to weatherize low-income homes have now been trained to be able to retrofit a middle-class home. It is not that different from a retrofit for a low-income home. It may not be grand and glorious. It is insulation, it is weather stripping, it is caulking, it is fixing the furnace.

To the extent to which those are community action agencies versus contractors, some of the specialization of fixing furnaces is a private sector contractor that comes in through those CAAs. So we are quite mindful of investing in a sector, being able to stand it up, and then being able to transform so that over the next 5, 10 years, virtually every home in America gets a tune-up. And we will have the workforce that has now been trained to be able to do that.

Mr. PASTOR. Okay. Mr. Israel.

Mr. ISRAEL. Thank you, Mr. Chairman.

Secretary Zoi, I appreciated what you said about catalyzing a clean energy transformation, and I very much enjoy the partnership that I have with you and your colleagues to that end.

Thirty years ago, Jimmy Carter wrapped himself in a cardigan sweater and declared the moral equivalent of war on our dependence on foreign oil. And in the 30 years since then we have done two things: We have doubled our imports of oil from the Middle East, and we have slashed Federal investments in research and development for renewable technologies and energy efficiency by 87 percent. And there is a correlation between those two things.

I was in Silicon Valley at the end of January on a clean tech tour. And on the front page of the New York Times was a story:

China Now Ahead of the U.S. in Clean Technology. So this is not just a matter of national security and environmentalism, it is a matter of our competitiveness in a global economy.

I think we are getting it right on a top-down investment. We have gone from slashing investments in research and development for renewable and energy efficiency, to going on the upswing sizably, and that is great. But where I still think we need work is the bottom-to-top investment, is making it easier for a homeowner or a commercial property owner to get a return on investment. Those are the three words that have been missing from this equation, "return on investment."

You are doing several things, the Department of Energy is doing several things in order to accelerate the return on investment so somebody can afford to put solar panels on a roof or swap-out energy-inefficient windows. One of the things that I have been clamoring for is PACE bonds, Property Assessed Clean Energy bonds, where anybody could have their local government finance those improvements, pay it back through a marginal increase in property taxes, and experience an immediate reduction.

I am concerned, however, that the Department doesn't seem to be embracing the notion that you should be using your loan guarantee authority to guarantee the local government bondings of energy efficiency financing.

I would like you to comment on that. Why shouldn't the Department of Energy immediately use its loan guarantee authority to help create this financing? I think that would be catalytic.

Two other quick questions.

The Vice President's Office announced a $454 million Energy Efficiency Conservation Block Grant that would in fact create demonstration projects for local financing of retrofits. I am curious as to when that is actually going to be announced.

And finally, what other plans do you have to catalyze, incentivize retrofits, and otherwise empower homeowners and large commercial property owners to engage in the kinds of retrofits that will transform the energy markets?

Ms. JOHNSON. There are some great programs that we have envisioned, including the retrofit. I am going to turn it over to Assistant Secretary Zoi to comment on those.

Ms. ZOI. Thank you, Congressman Israel. You referenced what I call retrofit ramp-up, the competitive EECBG program. That is the $454 million program that the Vice President announced. The solicitations are under final review, and we should be able to make announcements on those projects very shortly.

The great thing about that particular process is that we explicitly asked for leveraging. So what we got in a variety of proposals was very, very creative financing so that the sector would be able to stand up after the initial capital injection of money, and so that homeowners would be able to do either PACE loans or utility loans for the financing. There are a variety of measures that basically eliminate that first-cost disease and give consumers greater savings and allow them to access the retrofits.

We are also, as you may be aware——

Mr. PASTOR. So very shortly, meaning into the month, into the quarter, into the year? Can you just give us a sense?

Ms. ZOI. Weeks, not months; but it could be like more than 4 weeks.

Mr. ISRAEL. Is it safe to say a month?

Ms. ZOI. Yes. But making those precise decisions is above my pay grade. They are going to be a bunch of really exciting projects. Again, the design is to have them be replicable and have the whole Nation be able to access this.

In addition, as a complementary opportunity, the President has gotten behind the Home Star program, which would be a national point of sale rebate program so that every householder in America could go to the hardware store and essentially get a nice rebate for energy efficiency products that are going to save them money in their homes.

The design of the program, the structure, is to basically take advantage of the private sector players who know how to do this, and who have been doing it for a long time; to take advantage of the fact that there are a couple million unemployed construction workers who would like to pivot and be able to put insulation in people's attics; and to take advantage of the fact that 80 percent of Americans have either uninsulated or under-insulated homes. We have a win-win-win opportunity. But to stand up a permanent retrofit sector so that over the next decade or so, everybody in America gets a retrofit is worth pursuing.

Mr. ISRAEL. And what do we need to do in order to engage the Department in a serious discussion of using your loan guarantee authority to guarantee local financing?

Ms. JOHNSON. That is a great question. Let me just say the 1703 and the 1705 loan guarantee program has been focused on creating jobs at scale in the clean energy sector, either through manufacturing or producing clean energy. So we are asking in the fiscal year 2011 budget for a $500 million increase, additional funding for credit subsidies for 1703 to get them going. We have been focusing on job generation with the Recovery Act. I would be glad to take that back to our loan guarantee folks for consideration.

Mr. ISRAEL. Thank you. Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Rehberg.

Mr. REHBERG. You guys are smart, but please, please, please, be sensitive, with all of your intelligence, to a one-size-fits-all that does not work. Let me give you an example.

Under the new clean Congress, we are now told what we can lease as far as a car. The car I am now required to lease—I used to have a Chevy Tahoe, it was safe. My district, is of course bigger than Mr. Frelinghuysen's district. I have 147,000 square miles. It is the distance of Washington, D.C. to Chicago. I am allowed to drive the same car as Charlie Rangel in downtown New York City. So I am now in an unsafe car that actually gets worse gas mileage than the Chevy Tahoe I used to drive, but it is on the list that I am allowed to drive, because we have this one-size-fits-all attitude in Washington, D.C.

Some of my best friends are engineers, but I would never hire them. I do business with them, but I wouldn't employ them, because my one friend who has a doctorate in space physics, would lose his business within the first week because he doesn't have a business attitude. And I just caution you all, as you develop these one-size-fits-all proposals or policies, that they may not be applicable or appropriate to all of America. Please be flexible.

As I look at the budget, what I am particularly interested in is fossil fuels. Because that is Montana, it is our jobs. And this administration and, frankly, much of this Congress is kind of dumping on clean coal technology, oil and gas technologies, some of the new and exciting stuff that is out there. And it is not Exxon and it is not Shell that is doing it, it is the small, independent producers that are just struggling to take advantage of things like the new Bakken Formation, which is incredible.

But without the Department of Energy continuing to recognize the place of fossil fuels, until such time as we can move into the alternatives, we really are going to hamstring America's opportunity for economic recovery.

And so as I look at this budget, it angers me, the reprioritization under the new administration away from the traditional fossil fuels which, again, we are going to need a bridge; you are going to create a huge chasm if we turn our back and expect energy independence in America anytime soon using alternatives. And again, I am all for wind and solar and geothermal. Montana has a plethora of all of that. We have everything but nuclear and offshore drilling.

So I clearly get the geothermal and solar and wind—we have windmills as well in Montana—but we can't place all of our attention towards the alternatives at this time. And I recognize Mr. Israel's points. We have turned our back—I am glad he brought up Jimmy Carter because Jimmy Carter is the one who gave us the 55-mile-an-hour speed limit. For God sakes, it would take me forever to go anywhere in the District at 55 miles an hour. It became a joke out there.

So all I ask of you is a caution about one-size-fits-all thinking. And please don't entirely turn our back on the traditional fossil fuels, especially the clean coal technologies and some of the exciting things that can be done with zero emissions research technology and sequestration and such.

And I see Mr. Markowsky would like to comment. We don't even need you anymore as an Assistant Secretary because you have been zeroed. How do you like it?

Mr. MARKOWSKY. I think when you take a look at the budget, down $191 million, it can be misleading. When you look at the coal programs, which is the key thing, that has been essentially constant. And then with the advent of the $4 billion in the ARRA and carryover, we have a tremendous clean coal program to demonstrate carbon capture and sequestration.

Mr. REHBERG. Could I ask you, what percentage are you striving for? What do you think would be a success in carbon capture? What percent?

Mr. MARKOWSKY. In terms of renewable?

Mr. REHBERG. Yes.

Mr. MARKOWSKY. We are going for 90 percent, sir.

Mr. REHBERG. I know you are going for 90, but what do you think is doable, especially in the short term, because it has to be commercially viable, as Mr. Israel said. And if it is not, that is why we have a zero emission project going on at Montana State.

Mr. MARKOWSKY. That is exactly right. And the thing right now is we are demonstrating first-generation technologies because you have got to get those into both the power sector and the industrial sector, so those people are aware of what kind of technologies they are going to be up against. So they are going to have experience with that. However, the first-generation technologies are going to be a little too costly. That is why we are going with what we call second-generation technologies that will significantly reduce our costs.

Now, 90 percent is doable. In first-generation, that is what we are doing in most of those facilities. Some of them are down just below 90, but the cost is the issue. So, really, what we are driving in our program, both the current program and what we are envisioning going forward, is to get 90 or more percent CO_2 capture and make it cost-competitive. The way I see cost-competitive is, it has to be cost-competitive in 2020. And that is going to be natural gas combined cycle. The next one will be nuclear and wind. So that is how we are targeting our performance. We are looking at dispatch curves throughout the country, and we are targeting the cost performance based on those. So we are going to be there, sir.

Mr. PASTOR. Thank you.

Mr. Salazar.

Mr. SALAZAR. Thank you, Mr. Chairman. And I just want the previous speaker to know that I support what he is saying.

Under Secretary Zoi, I just want to thank you for the funding that we got for the final construction funding at National Renewable Energy Lab, very important for the State of Colorado, very important for the country.

Secretary Johnson, Congress provided $3.2 billion for the Energy Efficiency Conservation Block program in the stimulus. Of that, I hear that only 3 percent has actually been spent; yet I hear that proponents for this program are pushing for billions more. Is the Department considering further funding of this program?

Ms. JOHNSON. So there is about $11 billion for energy efficiency between the weatherization, the State energy programs, and the Energy Efficiency Conservation Block Grants. Nearly 100 percent has been obligated, and a good percentage has been contracted. As Assistant Secretary Zoi said, we are maybe somewhere between a third, moving up towards a goal of 75 percent contracted by the end of this month.

The amount spent—we don't count as spent until we have actually written a check. So the work has got to be contracted, completed, and billed to us. And so we expect that that will accelerate in the future, of course, since we have so much under contract and being obligated.

So we fully anticipate that the spending or the rate at which we are writing checks will increase. That doesn't mean that we aren't creating jobs now, that we aren't getting the work done now. And as Assistant Secretary Zoi said, we have almost tripled the rate at which we are weatherizing homes from December until today. And maybe Assistant Secretary Zoi would like to further comment.

Ms. ZOI. Yes. The EECBG that Congressman Salazar refers to is a brand new program, and there are 2,300 grantees with whom we have been partnering. The projects that are coming in at the local level are really exciting. I mean, there are libraries that are finally going to become energy-efficient public buildings at a local level. LED traffic lights are going to be nearly omnipresent at the end of this, which actually saves jurisdictions money.

With respect to having another EECBG, the work will actually be ongoing throughout fiscal year 2011. Hence, the President has not proposed that we have a new dedicated EECBG program in fiscal year 2011, to answer your question.

Mr. SALAZAR. Thank you. Under Secretary Johnson, how close are we to making a reliable, affordable electric car that can be utilized in the cities?

Ms. JOHNSON. Due to the opportunities presented to us by the Recovery Act, we have invested $2.4 billion in advance battery manufacturing for electric vehicles and plug-in hybrid vehicles. We have also invested in loan guarantees. We have made nine conditional guarantees; we have closed three. And those three are with Ford, Tesla and Fisker. Some of those are electrical vehicles and plug-in hybrid vehicles we expect to be on the road this fall.

And affordability I think is somewhat of an ambiguous term, perhaps; for some people it will be affordable. But we are driving through our ARPA–E grants, as I mentioned before, the all-liquid metal battery, which will tremendously decrease by an order of magnitude one of the biggest costs, which is the battery.

So if I could give you a time frame, I probably should quit my job and go invest in those companies, but I think that it is coming soon to a dealership near you.

Thank you for the support and for the opportunity to build that industry in this country.

Mr. SALAZAR. So do you think we will be able to build a $50,000, $40,000 car within the next couple years?

Ms. JOHNSON. I think we will see cars in that time frame on the market, yes.

Mr. SALAZAR. Thank you. Thank you, Mr. Chairman.

Mr. PASTOR. I just want to remind Congressman Salazar that it was through your effort that, in the creation of the three hubs, we insisted that the lab in Colorado be provided recovery money so we could improve the infrastructure. So thank you for your insistence on that.

Mr. SALAZAR. Thank you, sir.

Mr. PASTOR. Mr. Alexander.

Mr. ALEXANDER. Thank you, Mr. Chairman.

Good morning. As I was listening to Congressman Rehberg deliver his sermon on one size doesn't fit all, I was thinking that there is not another individual that has more authority to speak on that subject matter, because since he broke his foot last year in a boating accident, he wears two different sized boots. And that is a true story.

Dr. Johnson, President Obama has talked about jobs numerous times. During the time of 2002 to 2008, I understand that the job growth rate was 9 percent in the natural gas industry. In Louisiana alone, according to the Census report, 26 percent job increase in that field. So looking at the tax proposals that the President is sending out now, how would that help natural gas producers? Can you name one of those tax proposals that is going to help natural gas production if we are depending so much on that, today?

Ms. JOHNSON. I will turn this over to Assistant Secretary Markowsky for a comment.

Mr. MARKOWSKY. In natural gas, we are looking at exploration to increase that availability. In the past, we looked at shale gas and we have researched that. Now we have the horizontal fracking that has significantly increased the availability of that. We also developed methane from coal bed seams. So we did a lot of research. Now we are turning over and looking at methane hydrates, which is right off of Louisiana there in the Gulf, and we are going to be studying that with the Office of Science, because that is tremendous potential. What we are going to be exploring is the recovery potential of that gas from those hydrates.

So that is an area that I think is going to be very good in terms of developing the economy, jobs, and also a stronger energy future.

Mr. ALEXANDER. Is the President aware that there have been several significant finds in natural gas domestically?

Mr. MARKOWSKY. I can't speak for the President, but I am sure he is aware of it, because our production domestically has increased, as you recall. In 2004 and 2005, it was going down. And once we got into the horizontal drilling in the tight sands and also shale, it reversed that.

Mr. ALEXANDER. So when we talk about clean energy, natural gas is going to play a role, you think?

Mr. MARKOWSKY. I think natural gas has to play a role. When you take a look at natural gas, I mean, we are going to have energy storage for renewables, but you are going to need natural gas to back it up.

And also the industry, the coal-fired industry, is going to be looking somewhat towards natural gas, possibly, to do some retrofitting, repowering stations with it. Natural gas has expanded in the power generation sector. IC is going to expand it in the future. We are even looking at how we can capture carbon from natural gas, because we see it is going to be prevalent in the future and we need to be able to capture it to get the 80 percent reduction that we are striving for in 2050. Natural gas is going to play an important role.

Mr. ALEXANDER. In Louisiana, I know what fracking is, I can't tell you exactly how it works, it is a mystery to me. But I know we have several environmental groups that are down there now. I am beginning to stir a lot of trouble or controversy about the fracking process and what it might be doing to our groundwater or the environment overall.

Do we see a lot of concern out there? Are we going to put the brakes on with natural gas production because of EPA concerns or environmental group concerns?

Mr. MARKOWSKY. I think we have to get a lot more information. It is like anything else, something new. And there is a concern about groundwater. It is still not really thoroughly developed.

When you take a look at how much shale gas we are getting, it is a small percentage of our total gas right now, but the potential is great. So we need to explore that. I don't have an opinion on what the impact will be or what the potential environmental regulations will be, but we will be researching that very carefully so we can maintain that potential for the Nation.

Mr. ALEXANDER. Thank you.

Mr. PASTOR. We have been called and we will have three votes. What we are going to try to do is go down the list, Ryan, Fattah, Davis and Berry, and give you 5 minutes and then we will go vote and conclude the hearing if that is okay with you.

Mr. RYAN. I will try to be brief, Mr. Chairman. Thank you.

I have a few things I want to mention. One is Mr. Markowsky, if you can talk about this a little bit. We have a project on the Ohio River, Baard Energy, coal to liquid, loan guarantee issues, caught up in lawsuits, and I have got a great environmental record, but I get concerned sometimes that some frivolous lawsuits just to hold up development of these plants. It's about a 3 or $4 billion project on the Ohio River. Governor Strickland has been extremely involved in this.

Ohio EPA has done a great job, but now we are getting it held up because of some lawsuits. 3,000 construction jobs, I mean, just a boon for a region of the country that really could use a shot in the arm. So whether you can answer this now or we can talk off-line on it, it is something that Congressman Wilson and I are pushing a great deal because of the regional impact it would have.

So I wanted to just mention that to you and see if we can get some help from you guys on this issue. And let's talk off-line because I want to be mindful of the other guys that are here.

The second thing is to kind of answer what Congressman Alexander was saying. We used $20 million in stimulus money to help do some site prep work that landed the $650 million investment from a French company that does the oil and gas tubing because we are right on the Marcellus shale formation just in eastern Ohio; so the stimulus money is working in so many different ways because they could now access this natural gas shale and allow us to develop it.

So the stimulus was development money, but it was used to help, I think, the future of clean technologies. So one more comment and then a question.

We have got some old GE light factories in Ohio, and I don't know what the environmentals are on the sites because it is—they have been there for a long time. And I was wondering are there any incentives for companies like GE who are really doing the whole spectrum? They did the old technology. They are moving into the new technology. So are we creating or have we created any incentives for companies like General Electric who are running the gamut here to reinvest back into those old facilities that are, again, manufacturing, industrial Midwest, all the things we are trying to do with the green revolution? Are there any incentives there for companies like that?

Ms. JOHNSON. Absolutely. The Department of Energy through the Recovery Act has been asked to work with Treasury to award grants in lieu of tax contracts for exactly that kind of opportunity in 1603 and 48C. So we have probably put forth—I think we have already given about $4 billion in those kinds of grants out already so exactly.

Mr. RYAN. Do we develop sites?

Ms. JOHNSON. That is part of it, yes. And also for our loan guarantee, we did a project where we took a factory in Delaware and reinvigorated it for plug-in hybrid electric vehicles.

Ms. ZOI. If I could just add, in addition to 48C, which is the advanced energy manufacturing tax credit that Kristina referred to, some of the States are providing assistance under the State energy programs. I know Michigan is taking old factories and transforming them into clean energy facilities as well; so they are providing State assistance. So there are a number of different vehicles that can be used to get to that really noble objective.

Mr. RYAN. Terrific.

Lastly, we went to Israel a few years ago. Israel has a tremendous incubator system. They had—when the Wall fell, they had a lot of Russian Jews who were very, very skilled, talented engineers and very creative people. They didn't know what to do with them; so they started this incubator system in the mid '90s and it is a great public-private partnership. Mr. Israel mentioned pace and a lot of things but he was talking about top down. I think with the energy revolution, this incubator system would be prime for the Department of Energy, probably the Department of Defense too. But the Department of Energy, could to set up a national incubator system, focused in economically distressed areas where we can have all of these folks who are in the garage thinking of the next best thing, whether it is how to sequester and the equipment needed, or whatever the case may be.

So are there any plans to stand up some kind of national energy incubator system that I think could really unleash all of the talent that we have in the United States, not just locked in the ivory tower?

Ms. JOHNSON. You bet. It is a great idea and one of the things that we are with looking at and working with the Assistant Secretaries that are here, we took the 2.8 percent SBIR amount of the Recovery Act research, and we decided let's focus on trying to generate jobs in a clean energy economy by increasing the criteria for commercialization and job creation 50 percent for awarding these grants, and it was a special SBIR phase one ARRA grant, small business innovative research.

So we had 970 proposals; we funded 125. Sixty of those will go to phase two. In fact, if phase one is $150,000, phase two can go up to a million. Now, there is opportunity for a phase three grant, which can look at these companies that have one or two employees when they start you out, and within 2 years, go up to 50 and this amplification I am really excited about this opportunity. I would like to talk to you off-line, if I may.

Mr. RYAN. That would be great. Thank you. Let's hook up.

Mr. FATTAH. I do have a couple questions, but I'd be glad to yield to my senior colleague here.

Mr. BERRY. I would like to talk to you about the research money and how it is being spent and the absence of it in the lower Mississippi Valley, where we have more biomass production than the mind can imagine. But the only efforts that are being made there, we, in my opinion, have been dissed by the Department of Energy, but we have significant efforts, are all privately funded or funded by State moneys. And I would love to have a discussion with you about that.

And then I don't know what the situation is with refueling stations for natural gas and the production of natural gas burning internal combustion engines that we need to be replacing some of these diesel engines with, and I would love to know about that. You can respond for the record later. I know the time is short.

Ms. JOHNSON. That would be great. We would be delighted to do that on both of those accounts. Thank you, sir.

Mr. BERRY. Thank you.

Mr. PASTOR. Mr. Fattah.

Mr. FATTAH. Thank you, Mr. Chairman.

And if you would retire, we could probably get some research dollars over in that neck of the woods.

Mr. PASTOR. Guess who moves up.

Mr. FATTAH. I wanted to wait my turn. He doesn't have to leave on my account.

Let me get to a couple issues. One is there are two programs that I am principally interested in. The energy community block grant, you said we got some 2,300 community entities, cities, counties that are eligible and they have all gotten their allocations. And I am very interested in making sure that we expedite as efficiently as possible the outlays of those. I have met with a group of mayors on this subject at the Speaker's request.

So we can talk about that, but they are some very exciting projects. I think the more we get to get the spotlight on them, I think the more energy will be around, and increase the whole notion of how to localize this energy revolution.

The other program that I have been a major proponent of, is the nuclear loan guarantee program. I am very happy that the administration and the President have moved forward for the first time in some 30 years on new nuclear plants. So there are a lot of great things going on in the Department. I am very pleased with the testimony we have heard today. But I would like to know as we go forward on the loan guarantee program on the renewable side. You said there were some deal I believe. I think you said nine?

Ms. JOHNSON. Nine.

Mr. BERRY. Right. I met with a group of smaller entrepreneurs who thought that the size of the guarantees were too large for them—it really didn't fit their needs. And I want to know whether you have experienced that problem and whether or not the Department is looking at it or whether we need to as a committee look at how—whether we need to segregate a portion of the renewable loan guarantee for smaller entrepreneurs like some of the people who might be in a national incubator. So if you could respond to that.

Ms. JOHNSON. Right. I think that it would be great to continue some of the activities that we have that have reached out to the smaller business owners and the smaller loan recipients, more so in the 1603 and 48C manufacturing than, as you said, with the larger loans from 1703 and 1705.

So I think it is a matter of where you draw the line between small and large. I would be glad to follow up with you off-line and to really understand what the constituents' needs are; so that we can go back and make sure we are addressing those needs. So I would be delighted for us to follow up with you.

Mr. FATTAH. Two other points, then. The ranking member, who is my great friend from New Jersey, kind of walked us through the extremes here. At first the notion was that the Recovery Act wasn't going to accomplish anything. And now we are at the point of where it has been doing all this good, what are we go going to do when it stops? It shows that the Department has moved a great distance in this effort, and it is because of the tremendous leadership as demonstrated at the witness table today.

I am also interested in the question of diversity. We had the President's National Science Adviser before one of our committees and we were talking about the dearth of educational efforts by American students of any stripe pursuing terminal degrees. And he said that a lot of scientists' efforts are developed based on their experiences and if we don't get young people from all different kinds of backgrounds pursuing terminal degrees, we are going to miss out one on what they have to offer. So there's more that we need to do there.

Mr. PASTOR. Answer as quick as possible.

Ms. JOHNSON. That is exactly what RE–ENERGYSE is focusing on, using energy because everyone is so excited about energy; to get the continuum pipeline all the way through our elementary, junior high, high schools, all the way into the terminal degrees. So I would be glad to talk to you more about RE–ENERGYSE offline.

Mr. FATTAH. Thank you.

Mr. PASTOR. Mr. Davis.

Mr. DAVIS. First of all, let me say thank you for being here today. Obviously when you look at the Department of Energy and see the very positive impact on American lives that you have it is something that's significant. In the district that I represent, the Department of Energy certainly has an impact in the research that is going on, in the eastern part that I represent, Oakridge, Tennessee; so it has been a delight working with this department, obviously when it comes to the Oakridge National Lab as well as the facility at Y–12 NSA.

In 1977, I bought an automobile that got 50 miles to the gallon. It was a stick shift. It was a small diesel engine. I had three young daughters sitting in the back seat, buckle up, and my wife and I would drive that. I traded that to the '81 model that got less than half that amount. I traded it to a K car, which was one of Lee Iacocca's, and it was also four speed; the other one was a five speed. We have had the technology, I believe, but I am not sure we have had the desire, nor have we had the wherewithal in our minds to make things happen.

When I listened that we are going to spend $2 billion on battery-operated automobiles, I hope that that is a success, but here are a couple of things I want to ask you: I got a request—we have Democrat caucuses. T. Boone Pickens, some of you folks have heard of him. Back in the 2004 election, many of us Democrats didn't care too much for the Swift Boat Veterans for Truth being funded by this guy. I am not being harsh about it, but he came to speak at our caucus. And I thought I want to go to that because when I was a youngster growing up, there was this song about that talked about a lady that picked up a snake that was cold—you remember that song.

Mr. PASTOR. She is too young.

Mr. DAVIS. She's too young. It warms up, it bites her, and she dies from it. And she's saying, How could you do this? I saved your life. And he said, You knew I was a snake when you brought me in here.

So I wanted to go listen to make sure we weren't going to get bit by this guy. The fact is what he presented that day was moving closer and closer and farther away from crude oil to the use of natural gas for our transportation needs. You are spending two point something billion dollars for battery-operated automobiles. How much are we spending to look at research and development for combustion engines run by natural gas? Because today I see this basically in warehouses where they are using natural gas or propane gas. How much are we spending on that?

And the second thing I want to ask you, in 1975 to 1985, this country made a commitment, and much of it in Federal loan guarantees to the nuclear industry to build about a hundred nuclear reactors. And then Three Mile Island occurred and we all assumed that it was Chernobyl. So we just basically backed off.

And many other occurrences happened during that time. But we could build 300 nuclear reactors in this country that would produce us about another 60 percent of our energy. Including the 20 that we have, would be 80 percent, for about $1.2 trillion. That's a lot of money. We just gave a $700 billion bailout to the banks and we just authorized a $788 billion American Recovery and Reinvestment Act. It is not a stimulus package. It may stimulate the economy, but it is actually a Recovery and Reinvestment Act. So I don't like to hear the word "stimulus." That's not really what it was. $288 billion of that was in tax cuts.

So the question I am asking you is how many dollars are we spending on converting as a bridge source to the next generation of energy for natural gas—how much are we looking at for—as Carter said, coal liquefaction and gasification being a part of the mix. Are we spending an equal or a greater amount on the known quantities of energy we have today? For instance, from 1850 to 1900, there were 6 million windmills purchased in this country. In 1880, there were only 9 million households, but they were using those specifically for a purpose that would not provide continuity and so would not produce the economic engine we needed. In the early 1900s, we switched to turbines—hydroturbines from steam produced by coal. I don't want us to lose sight of what we have today and make that cleaner; instead of trying to go to one source or a solar source that we need, but produces only a small portion and we drive our economy into the ground.

And then the fourth question if I have got time——

Mr. PASTOR. You don't because we are running out of time. We have given you 5 minutes, but maybe you can respond quickly and then for the record.

Ms. JOHNSON. I will follow up for the record.

We are looking at a portfolio; so we are investing in internal combustion engines. We are looking at more efficient internal combustion engines. We believe we can get 25 percent more that from that design. We are investing $57 million. We are investing half of our 300 million clean cities grants in natural gas-propelled vehicles.

With regard to nuclear energy, we are asking in our fiscal year 2011 budget for 36 billion more in loan guarantees. That is because we have challenges in the supply chain. We have challenges in large-pressure vessels being manufactured in this country. We have challenges in our workforce. Which is why $5 million of RE–ENERGYSE is in nuclear energy.

So at each level of this particular issue, we are investing very strategically. I would be glad to get back to you for the record in a very complete summary, but we are pretty excited.

Mr. DAVIS. Thanks. And with all the money you have left over for the projects that were not shovel ready, can we look at some of those as possibly using those?

Mr. PASTOR. Secretary Johnson, I want to thank you and your colleagues. And this concludes the hearing. There will be questions on the record.

Ms. JOHNSON. Thank you, sir.

QUESTIONS FOR THE RECORD

ENERGY AND WATER DEVELOPMENT SUBCOMMITTEE
HOUSE COMMITTEE ON APPROPRIATIONS

DEPARTMENT OF ENERGY: OFFICES OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, FOSSIL ENERGY, AND ELECTRICITY DELIVERY AND ENERGY RELIABILITY

BUDGET HEARING

MARCH 17, 2010

---

1. COLLABORATION WITH OFFICE OF SCIENCE BIOENERGY RESEARCH CENTERS

Question: The three Bioenergy Research Centers (BRCs) funded through the Office of Science are large multi-year efforts aimed at developing new innovations in biofuels science and engineering. These centers are part of the Department's basic science programs, but their purpose is to ultimately create new ways to make biofuels from renewable sources and to push those new techniques into the private sector.

The BRCs consist of both basic and applied research and development, and it seems like a natural place for collaboration with the applied R&D offices. How have these centers collaborated with the Office of Energy Efficiency and Renewable Energy (EERE)?

How has the Department leveraged EERE's expertise with demonstration projects to enhance the BRCs?

What, if any, institutional challenges have made it difficult to establish collaborations between the BRCs and EERE?

Answer: Collaboration between the Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Science facilitates the development of key science and new technical tools to advance the energy missions of the Department of Energy (DOE). This collaboration plays an important role in the Office of Science's Bioenergy Research Centers (BRCs). The Bioenergy Science Center (BESC) at Oak Ridge National Laboratory includes a partnership with the National Renewable Energy Laboratory (NREL), which is managed by EERE. The Office of the Biomass Program (OBP) within EERE collaborated with the Office of Science's Biological and Environmental Research (BER) on multiple peer reviews, and in tracking the progress of all the Bioenergy Research Centers. This collaboration led to the recent announcement of a Process Development Unit to be built by EERE at Lawrence Berkeley National Laboratory to accelerate bringing the Bioenergy Research Centers' technologies to market.

Although the responsibility to manage and to enhance the activities of the BRCs largely rests with BER, OBP and BER have collaborated on the development of three BRCs. For example, BRC Program Managers have attended OBP Program Reviews on Integrated Biorefinery (IBR) demonstration projects. One important finding that emerged from the 2009 IBR Reviews is the need to ensure the availability of biomass feedstocks for IBR operation. Towards this goal, OBP is using a portion of the American Reinvestment and Recovery Act funds to work with the partners of the Great Lakes Bioenergy Research Center on field research and analysis focused on nutrient and carbon cycling and water quality under a range of biofuels production systems

2. PORTFOLIO OF BIOMASS SOURCES

Question: Biofuels and biomass electricity generation can be based on a variety of feedstocks, including corn and other existing crops, cellulosic sources such as switchgrass, residual woody biomass, algae, and waste products.

How is the Department of Energy dividing its work across this portfolio of biomass sources? How much funding did the Department devote to advancing biofuels and biomass systems using each of these types of feedstocks in the fiscal year 2010, and how much funding does the Department propose to devote to each type of feedstock in the 2011 budget request?

How has the Department arrived at these funding levels for the different feedstock types?

Answer: The Department of Energy's (DOE) Biomass Program supports research, development, demonstration, and deployment using a wide variety of non-food feedstock types. Efforts are categorized in terms of feedstocks, conversion, integrated biorefineries, and logistics areas as well as cross-cutting activities.[1]

Regarding feedstock R&D, the Biomass Program aims to address opportunities for sustainable feedstock production in as many U.S. regions as possible. The Program determines which feedstocks to pursue based on prior DOE RD&D activities and evaluations, analyses, and assessments as well as inputs from a series of regional workshops that were held with U.S. Department of Agriculture, academic institutions, industry, and other stakeholders prior to the establishment of regional trials in 2008. In FY10, nearly $1.6 million will support removal trials for corn stover or cereal straw; nearly $2.4 million will support herbaceous energy crop trials; and nearly $1.5 million will support woody energy crop trials.

Regarding conversion R&D, the Program bases its funding levels for different feedstocks on the most promising means for meeting near-term cost targets for making biofuels cost-competitive with existing fuels. In FY10 the Program is spending approximately $30.8 million on biochemical conversion activities that primarily focus on agricultural residues but are also applicable to other feedstocks. Additionally, the Program is directing approximately $26.6 million to thermochemical conversion activities that primarily apply to woody feedstocks. Advancements made through this work will be leveraged as the program expands its conversion R&D to include additional feedstocks. The Program is currently expanding its feedstock and conversion R&D activities in the area of algal biomass resources. The program is directing approximately $33 million in FY10 funds toward algae feedstock development, conversion, and demonstration through multi-year projects.

Regarding our integrated biorefinery projects, the Program assesses applications based on technical and financial review criteria—not on feedstock type per se. Applicants often identify certain feedstocks' viability in their business plans; through consideration of site-specific geographic, economic, and environmental factors, they select the feedstock or feedstocks they intend to use. Of the integrated biorefinery projects funded through FY10 appropriations, approximately $26 million will go towards projects using agricultural residue as their primary feedstock. Approximately $58 million will go towards projects using primarily woody feedstocks.

---

[1] Funding values do not include Small Business Innovation Research/Small Business Technology Transfer programs and programmatic taxes.

Regarding feedstocks logistics, the Program also funds five system demonstration projects through FY10 appropriations. The FY10 investment for the feedstock logistics projects is approximately $20.2 million: up to $8.8 million will support projects addressing supply systems for agricultural residues; up to $4.4 million will support a project addressing herbaceous energy crops; and up to $4.8 million will support projects addressing woody energy crops.

A portion of the Biomass Program's R&D is not specific to any single feedstock. For example, the Program funds biomass resource assessment activities that consider all feedstock amounts that are potentially available—on both environmentally and economically sustainable bases, and at regional and national scales. FY10 funding for such activities is approximately $3.6 million. Similarly, the Program funds R&D in logistics—which includes harvest, handling, preprocessing, storing, and transporting feedstocks—that is applicable to a variety of biomass feedstocks. FY10 funding for these activities is approximately $9.5 million.

For FY11, the Biomass Program has proposed feedstock production, conversion, logistics, and cross-cutting activities funding levels relatively comparable to FY10, except in algae given the large commitment in that area in FY10 and through Recovery Act funding. Of the FY11 appropriations for integrated biorefinery projects, approximately $26 million would go towards projects using agricultural residue as their primary feedstock, and approximately $28 million would go towards projects using primarily woody feedstocks.

3. Bio-Waste Feedstock

Question: In the fiscal year 2010 House Energy and Water appropriations bill, we included language that encouraged the Department to consider a broader portfolio of feedstock, specifically including algae. But there are certain types of feedstock that have no impact on the food supply or land use, such as bio-waste. Processing bio-waste as a feedstock could not only create energy, but it could help reduce contamination and pollution risks for land, air, and water.

Considering the amounts of bio-waste generated each year, what is the biomass program doing to look into other viable feedstock options?

The U.K. has had some success in the field of anaerobic digestion, which generates energy from bio-waste. Has the Department evaluated other international programs to help inform and steer this program?

Answer: Bio-waste, which includes the organic fraction of municipal solid waste (MSW) and biosolids, as well as food residuals and industrial sludges, is a significant source of biomass with the potential to generate biofuels and potentially biopower and bioproducts.

The Biomass Program is supporting several efforts related to using sorted MSW for bioenergy. The program funds biomass feedstock resource assessment work to determine the amount of feedstock potentially available nationwide and at the regional level on an environmentally and economically sustainable basis. These assessments include waste materials such as sorted MSW, as well as residues from existing agricultural operations, residues from forestry and pulp/paper operations, dedicated herbaceous energy crops, dedicated woody energy crops, and traditional commodity crops. Additionally, the Biomass Program's last solicitation for integrated biorefinery operations included sorted MSW as an eligible feedstock. Through this solicitation, the program is supporting a demonstration-scale biorefinery facility that will be sited at a landfill and will use sorted MSW for biofuel production.

Anaerobic digestion, or "Organic Recycling for Renewable Energy," is a viable process for capturing methane and using it for fuel and power applications. USDA's AgStar program has done much to support the use of anaerobic digestion for converting animal manure into heat and electricity, but DOE has not funded programs on anaerobic digestion of organic residuals since the mid-1990s. The Biomass Program is an executive committee member of the International Energy Agency, which facilitates international cooperation and information-sharing across a wide range of bioenergy RD&D efforts including energy from biogas and landfill gas.

4. PROGRESS ON CELLULOSIC BIOMASS SOURCES

Question: The Biomass and Biorefinery Systems program in the Office of Energy Efficiency and Renewable Energy (EERE) has a large emphasis on developing ways to produce biofuel from cellulosic biomass, which promises to provide transportation fuels based on feedstock that take less energy to grow and refine than currently available biofuel feedstock.

What is the status of cellulosic biofuels, and how far do you believe the cellulosic refinery technologies are from large-scale commercialization?

Is EERE's Biomass and Biorefinery Systems program currently focused on research and development, demonstration projects, or other activities to move cellulosic biofuel technologies forward?

Answer: EERE's Biomass Program invests in a variety of research, development, demonstration, and deployment projects strategically selected for their potential to lower the costs of producing cellulosic biofuels and to facilitate the commercialization of advanced biofuels technologies. Research and development is focused on making cellulosic biofuels cost-competitive with gasoline, achieving a modeled cost for mature technology of $1.76/gallon of ethanol by 2012, and achieving a modeled cost of $2.85/gallon of renewable gasoline, $2.84/gallon of renewable diesel, and $2.76/gallon of renewable jet fuel (in 2007$) by 2017. To achieve these goals, the Biomass Program's activities address all steps of the biofuels supply chain, from sustainable production of feedstocks through end use of biofuels in vehicles.

Of the Biomass Program's five commercial-scale projects, one initiated construction and the remaining four are expected to start the construction phase by the end of calendar year 2010. The demonstration- and pilot-scale projects are slated to be operational at various times over the next three years. Collectively, these biorefinery projects are anticipated to have an annual production capacity of up to 100 million gallons of cellulosic biofuels by 2014.

5. DIRECTION OF BIOFUEL RESEARCH AT NREL

Question: I have heard from some industry experts that the National Renewable Energy Laboratory (NREL) has been pursuing a dead-end path in its biofuel research for quite some time, and has refused to change direction or reassess the program.

Are you aware of these criticisms of the NREL biofuel program?

What direction is the NREL program heading, and is it proving to be a fruitful research path?

Answer: The DOE Biomass Program focuses its efforts on overcoming barriers to cost-competitive cellulosic ethanol. The decision to pursue cellulosic ethanol was based on the need for alternative fuels from non-food based feedstocks, the state of the technology needed to produce large volumes of fuels to displace gasoline, and the existing market for ethanol-blended transportation fuel. Recently however, the program at NREL has been accused of having a "fixation" on cellulosic ethanol at the expense of focusing resources on other fuels.

Because cellulosic ethanol is a natural transition from corn ethanol in the blend markets, NREL and DOE maintain their 2012 goal for cellulosic ethanol to help enable the technologies necessary to fill this near term emerging market.

However, ethanol as a fuel has some limitations. It is not as compatible with today's transportation infrastructure and has a lower energy density when compared to current petroleum fuels. While ethanol can be used to offset gasoline usage, it does not address needs for alternative fuels in the jet and diesel markets.

Therefore, the Department spent the last two years evaluating options from a technical and economic viewpoint and initiated a push towards "advanced biofuels" that are more infrastructure compatible and energy dense that can essentially be "drop-in replacements" for gasoline, diesel and jet fuel. In that regard, NREL in collaboration with Pacific Northwest National Lab (PNNL) formed a team consisting of esteemed academic and industrial partners who represent expertise across the value chain that are charged with developing these advanced biofuels technologies. This team, named the National Advanced Biofuels Consortium,[2] received approximately $35 million of DOE funds in competitive awards and has attracted approximately $12 million of industry funds. The Consortium's mission is to develop at least one pilot ready "advanced biofuels" technology that utilizes cellulosic biomass within the next three years.

In addition, much of the progress demonstrated for biochemical and thermochemical conversion of biomass to ethanol will not only serve to demonstrate the economic viability of cellulosic ethanol, but will also be extremely applicable to advanced biofuels and the needs of a broader set of U.S. transportation sectors.

---

[2] http://www.nabcprojects.org/index.html

6. FOCUS OF RECOVERY ACT BIOFUEL AND BIOMASS PROJECTS

Question: The Recovery Act provided $800 million for Biomass and Biorefinery Systems research and development in the Office of Energy Efficiency and Renewable Energy. What areas of research, development, and demonstration is the Department focusing on with these funds? What is the status of these projects, and have we learned anything yet about the scaling of advanced biorefinery systems from these Recovery Act projects?

What is being done, specifically, with the $138 million in Recovery Act funds for Commercial Scale Biorefinery Projects? If no funding has been obligated and spent to date, please provide a schedule for these projects.

How will the Recovery Act projects help to move advanced biofuels forward as a way to reduce our consumption of petroleum fuels?

Answer: The Department directed Recovery Act funds to more than 35 projects intended to accelerate advanced biofuels research, development, and demonstration; speed the deployment and commercialization of advanced biofuels and bioproducts; and further the U.S. bioindustry through market transformation and creating or saving a range of jobs across the biofuel supply chain. These projects directly or indirectly support an increased use of cellulosic and hydrocarbon biofuels to reduce consumption of petroleum fuels.

As of April 2010, the Department obligated over $509 million for 18 integrated biorefinery projects at the research and development, pilot, and demonstration scales that aim to validate integrated biorefinery technologies that could produce advanced biofuels, bioproducts, and heat and power in an integrated system. Successful pilot-scale projects will help advance the biofuels industry by validating the first integration of technologies and allowing for greater scale up, and successful demonstration-level projects will generate data to help enable our partner companies secure financing for commercial-scale replications. These integrated biorefinery projects are currently conducting activities involving environmental permitting including NEPA, engineering design, and securing funding. Assuming successful completion of these activities, some projects are anticipated to begin construction phases as early as Fall 2010. These projects are in addition to six other demonstration-scale facilities the Department is supporting through annual appropriations.

The Department obligated approximately $82 million in Recovery Act funds to an existing commercial cellulosic ethanol biorefinery project's construction phase to help ensure the project's planned start-up and commissioning in Spring 2011. As of April 1, 2010, the project remained on schedule. The plant intends to have the capacity to produce 19 million gallons of cellulosic ethanol biofuels annually, as well as other products. This plant is in addition to five other commercial-scale facilities the Department is supporting with annual appropriations.

Third, to accelerate fundamental research related to biomass and biofuels, the Department obligated approximately $107 million in Recovery Act funds that aim to develop cutting-edge technologies. For example, the Biomass Program supports the following:

- Two consortia projects funded at $49 million for algal biofuels and $35 million for hydrocarbon biofuels, respectively, that involve around 50 industry, academic, and laboratory partners. Both projects intend to develop more cost effective means of producing, harvesting, and converting feedstocks into hydrocarbon biofuels.
- Nearly $18 million for an advanced biofuels process development unit (PDU) was recently obligated. The PDU is capable of small-scale demonstration and validation of advanced biofuels production processes. It will be available for use by entrepreneurs, universities and research centers to demonstrate integration of process steps, validate progress towards advanced biofuels targets, as well as to overcome key technical barriers hindering development and deployment of biofuels technologies.
- More than $5 million obligated toward feedstock sustainability research projects to understand and better analyze nutrient and carbon cycling, hydrological impacts of woody crops, and other impacts associated with increased biomass and biofuel production.

To support research and use of ethanol blends, the Department has obligated nearly $20 million to several projects at the National Laboratories and with two major industry partners. Specifically, $16 million has been obligated to evaluate the impact of intermediate ethanol blends on engines, materials, and infrastructure components; and nearly $3 million for engine optimization of flex-fuel vehicles. In addition, about $1 million has gone to 6 states to modify more than 50 retail fueling pumps, and associated infrastructure, to dispense ethanol blends up to E85. These projects are underway and all aim to support evaluation and maximization of our existing infrastructure's capacity to utilize more ethanol.

Last, about $13.4 million in funds were directed toward an expansion of the existing Integrated Biorefinery Research Facility at the National Renewable Energy Laboratory to accommodate a greater number and variety of collaboration requests from industry partners who wish to test integrated pilot-scale biochemical conversion processes.

7. STATUS OF ALGAE AND OTHER ADVANCED BIOFUELS RESEARCH

Question: Algae and other non-conventional feedstock are so far unproven sources for biofuels, but they may have significant advantages over conventional crops. For example, the production of algae biofuels may allow for the use of marginal lands that would otherwise be unusable for agriculture. How is the Department dividing its funding between conventional and non-conventional feedstock research and development?

Answer: The Department of Energy's Biomass Program focuses its feedstock research and development efforts on non-conventional feedstocks, such as cellulosic biomass and algae, rather than conventional crops, such as corn. The non-conventional feedstocks the Program is pursuing include dedicated herbaceous energy crops such as switchgrass and energycane, and dedicated woody energy crops such as hybrid poplar and willow. Additional feedstocks the Program supports include residues from existing agricultural operations like corn stover and wheat straw; residues and thinning from forestry operations; waste materials such as sorted municipal solid waste; and algae. The program recently increased its investment in algae, which shows promise as a feedstock that can be grown on land not suitable for food production. Funded through the Recovery Act, the Program selected an algae research consortium to focus on algal biology research, improving yields, and overcoming other feedstock-related barriers. Additionally, four integrated biorefinery projects selected under the Recovery Act will focus on algae biofuels technologies at the R&D, pilot, and demonstration scale. FY 2010 base appropriations are supporting additional algae feedstock development, conversion, and demonstration projects. Conventional crops, such as corn, are included in the Biomass Program's resource assessments and are addressed in some of the Program's sustainability and analysis work for the purpose of better understanding the differences between conventional biofuels and advanced biofuels.

8. LIFECYCLE EMISSIONS OF BIOFUELS FROM ALGAE

Question: A January 2010 study published in the journal Environmental Science and Technology reported that biofuels from algae may have significantly higher lifecycle energy use and greenhouse gas emissions than previously thought.

Does the Department share these concerns about algae biofuels?

How do analyses of lifecycle emissions, energy use, and other factors inform the Department's decision to pursue different biofuels feedstock?

Answer: The study by Clarens *et al.* compares algae to conventional crops being considered for biofuels production, including switchgrass, canola, and corn. These modeling efforts show that algae compare negatively to these feedstocks with regard to greenhouse gas (GHG) emissions. However, the authors point out in the text that, "algae production processes are still in their infancy such that the system modeled here represents a 'first-generation' approach...", and that "... significant improvements in algae cultivation could increase the favorability of energy production from algae over the next several decades".

Lifecycle analyses (LCA) play a central role in the DOE decision-making process, and the Biomass Program is actively performing comparable LCA for algae and other feedstocks in partnership with DOE National Laboratories. These studies will consider updated process designs and inputs, including the technologies suggested by Clarens *et al.* The Energy Independence and Security Act of 2007 requires advanced biofuels to meet a minimum of 50% reduction in lifecycle GHG, and favorable GHG emissions and mass-energy balance are among the technology evaluation criteria for the Biomass Program.

9. "SOLAR ZONE" INITIATIVE

Question: The Department is proposing a new $48 million initiative in the 2011 request for a concentrating solar power demonstration project.

What are the merits of a large demonstration project for concentrating solar power, when there has already been a strong pipeline for large projects of this type in the Southwest for several years?

What gap does this proposed activity fill for commercializing a technology that many analyses show is already economically competitive with other conventional electricity generation plants?

Answer: The Solar Demonstration Zone Initiative is being designed to provide a critical demonstration of next generation CSP technology that will allow DOE to achieve its 2020 and beyond cost goals. It will also allow CSP technology developers to acquire critical operational performance data that can be used to obtain financing for larger scale projects. While over 6 GW projects have been announced throughout the U.S. Southwest, the CSP technologies for these projects have levelized energy costs that are only competitive with peak generation rates, and only when the 30% Investment Tax Credit (ITC) is included. To be competitive with lower baseload rates and without the ITC requires the development of advanced tower systems employing higher temperatures, thermal storage with 16 hour capacity, and other advanced components. Successful commercialization of these technologies requires significant capital. However, conventional capital sources cannot be depended on to finance the early commercialization steps given the level of technical and operational cost risk.

The Solar Development Zone Initiative is intended to fill this gap by providing both land for large scale demonstration, as well as National Laboratory support to verify performance. This information could potentially then be used to fund larger scale projects through the DOE Loan Guarantee Program or conventional finance sources.

10. SOLAR PHOTOVOLTAIC COST REDUCTION TARGETS?

Question: According to the budget request, commercial photovoltaic systems installed today can produce electricity for 10 to 14 cents per kilowatt-hour, including federal tax incentives. The Department has also put forth a cost target for these systems at 4 to 6 cents per kilowatt-hour by 2015.

At these costs, photovoltaic solar power would be competitive with nearly any other power generation source. Does the Department believe that solar will be cost-competitive in five years, as the budget request seems to indicate?

How does the Department arrive at these projections? Who does the analysis, and is it meant to be a realistic forecast of future costs that inform the Department's investment decisions?

Answer: As residential, commercial, and utility markets have significantly different electricity prices, discussions of cost parity for photovoltaics need to be market-specific. Additional considerations include total system price, incident solar energy, interest rates and other financial assumptions, all of which have a significant impact on levelized cost of electricity from photovoltaics.

At an installed cost of $5.0/Watt in 2009, utility PV systems produce electricity at a cost of 10 to 14 cents per kWh, inclusive of the 30% ITC and 5-year MACRS depreciation and assuming high solar insolation (e.g. Southwestern location). At a targeted installed cost of $2.2/Watt and with the same Federal incentives and location assumptions, utility PV systems could produce electricity at a cost of 4 to 6 cents per kWh, making it cost competitive with traditional forms of utility electricity generation. To hit utility grid parity without subsidy will further require a greater than 50% reduction in cost. While module prices have dropped significantly over the last 2 years, other balance-of-system (BOS) costs such as inverter, installation labor, and overhead and other costs have not dropped at the same rate. Achieving unsubsidized utility grid electricity parity by 2015 through photovoltaics will be a significant challenge that DOE is addressing through investments targeted to industry and the National Laboratories.

Achieving unsubsidized grid parity for residential PV systems is considered a more achievable goal. At current system prices of $7.0/Watt and assuming the 30% ITC without state-specific incentives, residential PV systems produce electricity at a cost of 16 to 19 cents per kWh in high solar insolation regions. While this is higher than for utility PV systems, the inherent higher prices for residential electricity and the falling costs for PV systems indicate that unsubsidized residential grid parity could occur in some regions of the country by 2015, such as Northeastern states with high residential electricity rates and Southwestern states with high solar insolation.

DOE's analysis of cost targets is based on projections of cost and efficiency improvements in modules and inverters, as well as market developments reducing margins and overhead costs. The solar insolation values are from the NREL/DOE solar resource maps. The financial assumptions are based on input from the financial community, including a 2009 comparative levelized cost of energy (LCOE) analysis published by the financial firm Lazard.

Analyses are performed by in-house analysts, as well as analysts at NREL. DOE also looks at analyses performed by outside organizations to ensure that our analyses are in-line with those of others looking at the industry. These analyses are used as a realistic forecast of future costs to inform our program investment decisions.

11. PHOTOVOLTAIC MANUFACTURING INITIATIVE

Question: The budget request increases photovoltaic technology research and development nearly $24 million, primarily to fund the new photovoltaic manufacturing initiative.

Can you describe how the industry and university consortium associated with this initiative will operate, and the Department's associated role?

Your budget request indicates that this initiative will involve both companies and universities. What is the cost share requirement for participating universities, and will partnerships with industry help universities to cover the cost share burden?

Answer: The PV Manufacturing Initiative is being designed to help build a strong U.S. manufacturing base in this important industry by funding collaborative research through both university and industry partnerships. The Initiative will consider funding of two different topics:

- University-Focused– to engage the Nation's world-class universities to conduct industry-relevant research and development projects related to PV manufacturing; and
- Industry-Focused – to accelerate the development and implementation of PV manufacturing-related technologies through collaborative research and/or pilot-scale manufacturing development facilities.

Consortium models are being considered for both topics. Consortium models for university research have been demonstrated in the semiconductor industry through such organizations as the Semiconductor Research Corporation. In this model, industry participants define, select, and fund research at universities in topics that have industry relevance. Under the University-Focused topic, DOE would provide seed funding to one or more organizations with the goal of it being self sufficient within 5 years. The cost share requirement is 20% of the total budget provided by member companies and not the universities themselves. Furthermore, other non-federal sources of funding such as state grants as well as in-kind contributions may also be considered towards the 20% cost share minimum.

For the Industry-Led, DOE would fund one or more organizations that are collaborating on a specific PV technology or other critical part of the PV supply chain that can have substantial impact on the U.S. industry. The funded organizations will be guided by member organizations that would include PV manufacturers and their associated supply chains. The organizations will define industry product and process improvement opportunities, choose and implement relevant R&D projects, manage the funding for the selected projects, and monitor their progress and results. The intent is for the industry members to identify areas for collaboration with the highest need within the domestic PV manufacturing industry. While a consortium model has not previously been demonstrated for the PV industry, DOE believes it may offer the best opportunity for companies to move toward industry standards and leverage research funding. This will become increasingly important as PV costs fall and industry margins compress. For the Industry-Focused topic, the cost share requirement is 50% of the total budget. As in the University-Focused topic, non-federal sources of funds or in-kind contributions can be considered towards the 50% cost share minimum.

DOE will participate in the management of both organizations and review annual performance. Performance criteria will be based on financial, intellectual property/licensing, technological and scientific progress, as well as educational metrics consistent with the DOE's Merit Review Process.

12. U.S. COMPETITIVE POSITION IN THE SOLAR INDUSTRY

Question: We've recently seen foreign solar companies building solar manufacturing facilities in the United States, and foreign companies acquiring U.S. solar companies. The recent acquisition of Ausra, a Silicon Valley solar startup, by Areva, a French energy company, is just one example.

How well is the U.S. solar industry positioned to lead the way in ownership of solar companies, in domestic manufacturing, and in private sector research and development that creates new intellectual property?

Which programs within the Department of Energy specifically help the global competitiveness of the U.S. solar industry, and what is included for these programs in this budget request?

Answer: The U.S. has a robust R&D infrastructure in solar technology supported by DOE and private sector investments. The National Laboratories, U.S. university research laboratories, and domestic industry have been strong developers of technological innovation and intellectual property in solar research. The U.S. maintains leadership in segments of the Photovoltaic (PV) supply chain. Approximately 40% of polysilicon, the semiconductor used in about 80% of worldwide PV modules, is produced by U.S. companies. U.S. companies also have significant market share for the capital equipment used in PV manufacturing. Additionally, U.S. manufacturers lead the PV industry in terms of module efficiency such as with products from Sunpower; module cost such as with products from First Solar; and flexible modules such as with products from United Solar.

However, strength in science and technology measured by the number of research publications and patent applications has not directly translated to domestic manufacturing strength. The two largest U.S. solar companies, First Solar and Sunpower, combined manufacture approximately 90% of their products overseas due to tax and labor advantages as well as other manufacturing incentives such as access to low cost capital offered by foreign governments. While the U.S. currently installs roughly the same volume of PV modules as is domestically manufactured, domestic manufacturing will need to increase capacity significantly to meet projected domestic demand in the coming years. The Advanced Energy Manufacturing Tax Credit (48C) Program and the DOE Loan Guarantee Program are helping to address that need. DOE assisted the Department of Treasury in awarding $2.3 billion to qualified advanced energy projects recently under the 48C program. Approximately $1 billion of the credits were awarded to PV and Solar Thermal manufacturing companies for expansion of domestic manufacturing operations. Some of these awards were made to foreign companies launching U.S. based manufacturing. To date, $1.9B in loan guarantee conditional commitments have been made to solar manufacturing and generation projects.

The DOE's Solar Energy Technologies Program also supports the domestic industry with programs that span research, development, demonstration, and deployment. The FY11 budget includes the new PV Manufacturing Initiative that is designed to help secure a strong domestic manufacturing base by funding collaborative research through both university and industry partnerships. The goal of this $125M over 5 years effort (subject to annual appropriations) is to support the creation of a robust U.S. PV manufacturing base, develop a green manufacturing workforce, and speed the implementation of new cutting edge technologies.

DOE will continue to closely monitor the domestic manufacturing and demand situation and work on programs and policy options that can assist US manufacturing competitiveness in this important sector.

13. WORKING WITH OFFICE OF SCIENCE RESEARCH WITH SOLAR APPLICATIONS

Question: The Office of Science conducts a variety of research activities with potential applications for solar energy technologies, including a number of energy frontier research centers and various activities in the Basic Energy Sciences program.

How is the Office of Energy Efficiency and Renewable Energy (EERE) leveraging research occurring in the Office of Science that could have applications in solar technologies? How is EERE working to commercialize basic innovations in the Office of Science?

Answer: The Solar Energy Technologies Program (SETP) in EERE is actively working to improve the identification of promising research in the Office of Science that offers new approaches to solar-powered electricity generation, with the goal of transitioning these approaches into the technology development pipeline supported by EERE. The SETP's Next Generation Photovolatics program funds early stage, breakthrough PV device development. Recent recipients were selected by reviewers from both the Office of Science and EERE. For the next round of this program, SETP is again working closely with the Office of Science to see which technologies emerging through its programs (including the EFRCs) might be appropriate for Next Generation PV program funding. To help identify further opportunities for collaboration, the Office of Science detailed one of its staff to the SETP on a part-time basis.

SETP also has several programs to support innovations once they are ready for commercialization. The PV Incubator program is designed to support demonstration of PV cell and module prototype development and scale-up, providing funding directly to early stage companies. Through this program, companies also receive strong support from the National Renewable Energy Laboratory and access to its scientists and engineers. Companies that have successfully completed this program have gone on to raise significant private capital or apply for the DOE Loan Guarantee program for manufacturing scale-up. All SETP awards to private companies are based on a competitive process with applications reviewed by an independent panel of experts.

14. SMALL WIND TURBINES

Question: Out of a total request of $122.5 million for wind energy technologies, the request includes just over $5 million for small wind systems. Is this investment commensurate with the resource potential for small and distributed wind energy systems?

Answer: According to estimates from the American Wind Energy Association, it is technically possible for small wind turbines to supply up to 3% of the Nation's electricity by 2020. Funding distributed wind energy systems[3] at $5.3 million is an appropriate level of support to help catalyze the development of the resource potential for these systems. The Department invests in small wind technologies because they fill a unique market role by providing behind-the-meter or off-grid power to homes, businesses, and communities, and because small wind turbine deployment can build public acceptance for utility-scale wind power. In addition, world markets for small wind turbines are dominated by U.S. companies, and the Department's investment in small wind technology can help these companies bring high-quality products to the marketplace to meet domestic and international needs for clean energy. The Department is also initiating an effort to develop mid-size wind turbine systems, which have the potential to provide vast amounts of renewable power to businesses and communities across the Nation.

---

15. DEPLOYMENT OF OFFSHORE WIND ENERGY

Question: The bulk of the domestic wind energy is being harvested from the Central Plains region, which is located far from the main population densities of the U.S., presenting rather significant transmission and distribution challenges. Conversely, offshore wind areas in the Northeast and along the west coast—generally rated as superb or outstanding resource areas—are located in close proximity to densely populated areas, mitigating those challenges. So, I would think that offshore wind must be a continued priority for the program if the U.S. is serious about meeting the goal of 20% wind energy by 2030.

What would you consider to be the major impediments to expanding the capacity for offshore wind power generation?

Does sufficient domestic manufacturing capacity exist to produce the larger turbine blades and components required for that level of power generation?

If we do not have sufficient domestic capacity at this time, what is being done to increase the domestic manufacturing capability and make the U.S. more competitive in this market?

Answer: In Fiscal Year (FY) 2011, DOE will initiate a formal activity, titled the Offshore Wind Innovation and Demonstration (OSWInD) Initiative, to promote and accelerate responsible commercial offshore wind development in the U.S.

Key barriers to the development and deployment of offshore wind technology include the relatively high cost of energy, technical challenges surrounding installation and grid interconnection, and the untested permitting requirements for siting wind projects in federal and state waters.

The OSWInD initiative must accomplish two critical objectives to overcome these barriers: reduce the cost of offshore wind energy and reduce the timeline for deploying offshore wind energy.

The OSWInD Initiative will initiate or expand a suite of three focus areas – Technology Development, Market Barrier Removal, and Advanced Technology Demonstration Projects – encompassing seven major activities: innovative turbines; innovative balance of system; computational tools and test data; resource planning; siting and permitting; complementary infrastructure; and advanced technology demonstration projects.

These seven activities will facilitate gigawatt-scale offshore wind power deployment and will augment the nearly $100M allocated to offshore wind research and test facilities through the American Reinvestment and Recovery Act of 2009 (ARRA).

DOE is currently engaged in several ongoing offshore wind activities, several of which are targeted at bolstering the currently insufficient domestic offshore wind manufacturing capacity. These activities are summarized below.

DOE has invested a total of $99.5 million through the American Reinvestment and Recovery Act of 2009 (Recovery Act), FY09 appropriations, and FY10 appropriations into offshore-related activities within the Wind Program. Current offshore wind activities support all three focus areas of the OSWInD Initiative: technology development, market barrier removal, and advanced technology demonstration projects.

Major activities in support of the technology development focus include the large drivetrain testing facility at Clemson University; the large blade test facility at Massachusetts Clean Energy Center; and research conducted at the University of Maine, the University of Delaware, and the University of Toledo. The large drivetrain and large blade test centers provide national infrastructure for full-scale tests of key turbine components. The facilities will enable testing of 15 MW drivetrains and blades up to 90m in length. These facilities are important national investments, as there are currently no facilities in the United States capable of testing the large drivetrains and blades predicted for offshore wind technology deployments. Research conducted by the universities will result in the validation of coupled aeroelastic/hydrodynamic models for floating wind turbine platform deployments; modeling work on two-bladed, downwind floating turbine concepts; feedback to technology developers on corrosion protection and gearbox reliability; and materials innovation using composites for tower and blade structures.

Ongoing market barrier removal activities include environmental research at the University of Maine and Michigan State University; projects addressing marketplace acceptance at the University of Delaware, Sustainable Energy Advantage LLC, the Great Lakes Commission, Princeton Energy Resources International, LLC, and the South Carolina Energy Office; and workforce development work at the University of Massachusetts, University of Maine, University of Toledo, and University of Delaware. The environmental research is investigating avian, bat and marine animal interactions for both the great lakes and the Atlantic seaboard. The market acceptance research is investigating solutions to current barriers for offshore wind deployment. The workforce development activities will result in new curricula specific to offshore wind energy at the community college, university undergraduate, and university graduate levels.

One activity supporting the advanced technology demonstration project focus area is the deployment of a floating platform and turbine. Through the Recovery Act, DOE funds the University of Maine to deploy a 100 kW wind turbine mounted on a floating platform in deep water in the Gulf of Maine. The University of Maine will deploy a turbine and foundation design from three initial concepts that will be tested in a wave tank testing facility. The turbine will be instrumented to gather empirical data that will be used to validate current aero-elastic/hydrodynamic models.

In addition to the activities mentioned above, DOE maintains a core competency of technical experts, distinguished in their fields, throughout the DOE national laboratory complex. These experts support key activities essential to the national agenda. Finally, DOE is actively engaged in interagency collaborations through activities associated with the DOI-DOE MOU and the National Ocean Council, along with other collaborations attempting to address the myriad of regulatory and permitting issues.

16. BUDGET REQUEST FOR OFFSHORE WIND RESEARCH AND DEVELOPMENT

Question: The 2011 budget request includes $49 million for a new activity that explores the financial, regulatory, technical, environmental, and social barriers for deployment of offshore wind energy.

How much of this funding for offshore wind research and development would be devoted to the proposed offshore demonstration project?

What will the Department and the wind industry learn from this demonstration project? How is it different than existing or proposed offshore projects in the U.S. and abroad?

Power transmission from offshore wind projects presents unique technical and economic challenges. How is the Wind Energy program collaborating with the Office of Electricity Delivery and Energy Reliability on this issue?

Answer: The Department anticipates allocating up to half of its FY 2011 request for offshore wind energy towards an offshore wind demonstration project or projects. The demonstration project will be a cost-shared partnership, chosen through a competitive solicitation, to develop one of the Nation's first commercial offshore wind power projects.

Although some experience with offshore wind energy exists in Europe, offshore wind in the U.S. faces unique technical, financial, regulatory, and environmental issues. The demonstration project will help overcome investor uncertainty and the lack of experience with offshore wind in U.S. waters, ultimately benefitting the entire U.S. offshore wind industry. Demonstration project activities will focus on reducing common barriers to offshore wind deployment. Specific activities that will broaden the industry knowledge base could include innovative engineering on foundations and infrastructure, optimization of turbine installation methods, and environmental assessment and permitting support. In the longer term, the Department's offshore wind research and development efforts will address technical challenges unique to U.S. offshore conditions, including the optimization of wind turbine designs for the U.S. marine environment, the development of transitional-zone and deep-water foundations, and the development of robust designs that can withstand hurricanes and other major storms that occur in U.S. waters.

The Department's Wind Energy Program and Office of Electricity Delivery and Energy Reliability collaborate on a range of issues related to the interconnection and integration of wind energy into the Nation's power systems. As the proposed offshore wind energy activities commence, this collaboration will expand to encompass the issues surrounding the transmission of offshore wind energy.

17. ACTIVITIES TO RESOLVE BARRIERS TO WIND DEPLOYMENT

Question: I understand that wind is one of the most cost-competitive renewable energy sources at this time.

What are the barriers currently preventing wind generation from being deployed, and what barriers will continue to prevent the widespread deployment of wind power in the coming decades?

How are the activities in the budget request for the wind energy program specifically targeting these barriers?

Answer: Numerous institutional, siting, and regulatory barriers, distinct from technology cost and performance issues, slow the adoption of wind power. Barriers preventing wind generation from being deployed to its full potential include:

- The lack of adequate transmission lines in the most resource rich areas is the most significant barrier to taking advantage of the Nation's vast wind resources.
- A complex and challenging regulatory environment delays timely market growth. Various agencies at the local, State, and Federal level are involved in reviewing and approving wind projects each with different regulatory requirements depending on the location. This complexity is especially true for siting projects on Federal lands and in the Nation's federally-managed waters.
- A lack of public/stakeholder understanding within some local communities and with some key decision makers limits public acceptance of wind power growth.
- The perceived potential risks to wildlife and habitats, specifically to birds and bats, and the related regulatory requirements of the Endangered Species Act and Migratory Bird Treaty Act limit the widespread deployment of wind power.
- Real and perceived interference with military and weather radar, and stakeholder uncertainty about these issues, limit the growth of wind power.

The Department of Energy's Wind Program works to remove barriers to large-scale and community wind power deployment and to increase the acceptance of wind power technologies by engaging key stakeholders and researching siting, transmission integration, and potential environmental and social concerns. The Wind Program is taking a proactive approach to addressing these barriers today and in the long term:

- The program's renewable systems interconnection activities will continue to tackle issues surrounding transmission planning and the integration of wind into the electrical grid.

The program will continue to work with the Office of Electricity Delivery and Energy Reliability and transmission and energy distribution industry groups to overcome these barriers.

- The program will expand its coordination with the Department of the Interior's Bureau of Land Management and Minerals Management Service to improve the permitting and regulatory processes for wind projects being sited on Federal lands and waters.
- The program will continue to support field research and analyses related to potential environmental and social risks, including collaborative research with the Bats and Wind Energy Cooperative and the Sage Grouse and Shrub Stepp Species groups. These public/private/NGO partnerships help build the knowledge base that will reduce potential risks to endangered species and species of concern.
- The program will continue to work closely with the Federal Aviation Administration and the Department of Defense to address radar and other military issues affected by wind turbines.
- The program also expects that States, industry, developers and other parties will insert resources to promote and support sustainable wind development across the country.

18. WIND TURBINE LIFESPAN

Question: Modern fiberglass wind turbines are still a relatively new technology, and these new turbines have not been in the field long enough to know how long each turbine lasts. We are hearing reports that turbine lifespan may be much shorter than previously thought—possibly seven years instead of the commonly-cited twenty year lifespan. Further, the lifespan of turbine blades is a major determinant of wind power economics.

Does the Department recognize turbine blade lifespan as a potentially serious problem for the economics of wind power?

I understand that turbine manufacturing, to a large extent, came out of the boat industry, and it is best characterized as a craft where workers lay down fiberglass sheets by hand. Several companies are researching promising new ways to automate manufacturing and therefore dramatically increase the reliability of lifespan of turbine blades. Is the Department working with industry to pursue these kinds of manufacturing innovations?

Answer: The Department recognizes the importance of reliable, long-lasting wind turbine blades in ensuring a low cost of wind energy. The Department conducts a number of activities to improve blade design, fabrication, and reliability, including extensive structural testing of wind turbine blades at the National Wind Technology Center in Colorado, and the development of a Wind Technology Testing Center in Boston, Massachusetts, to reduce costs, improve technical advancements, and speed the commercial deployment of new blade designs. The Department also initiated a Blade Reliability Collaborative with industry to identify and address issues affecting the premature failure of blades.

The Department funds research and development of new blade concepts, including advanced blade designs, incorporation of new materials, and "smart" blades, which have the potential to reduce blade costs, improve reliability, and increase energy capture. As part of these efforts, the Department funds several projects with industry to improve blade manufacturing, including through the use of automated blade fabrication processes and non-destructive inspection of blades.

19. TREASURY DEPARTMENT'S SECTION 1603 AND 48C TAX CREDIT PROGRAMS

Question: The economic downturn of the last several years threatened to stall the wind energy sector in the United States, at a time when only a few U.S. wind turbine manufacturers were competing with foreign companies.

Have the Treasury Department's section 1603 and 48c tax credit programs helped both to increase installed wind energy capacity and wind turbine manufacturing capacity in the United States?

How would you respond to criticisms that the section 1603 program funding has gone primarily towards turbine components manufactured outside of the United States?

Answer: Wind was one of the largest categories in the 48C energy manufacturing tax credits program. About 50 wind manufacturing projects are receiving $350M in tax credits for over $1.1 billion in investments through the 48C program. In addition to manufacturing completed turbines, the projects include new U.S. manufacturing of towers, blades, nacelles, gearboxes, generators, composite fiber, and other components and materials. A number of new wind manufacturing facilities are under construction, have been announced, or are planned, representing thousands of new jobs. Wind manufacturing in the U.S. is expected to grow dramatically in coming years. The Section 1603 grants go to U.S. clean energy projects, built in the U.S. by American workers. About half of the content of the wind turbine equipment comes from U.S. production and with the current rate of new investments in U.S. based manufacturing, DOE expects that the domestic content will soon be over 70%.

20. CHALLENGES WITH WIND INTERMITTENCY

Question: I've known about the intermittency problem for wind farms due to day-to-day changes in wind speeds at wind farms. I only recently learned, however, about the strain on the grid and nearby power plants associated with the hour-to-hour unpredictability of wind speeds.

What is the wind energy program doing to address issues of day-to-day and hour-by-hour wind speed intermittency? How is the wind energy program coordinating with the Office of Electricity Delivery and Energy Reliability on this and similar issues of renewable energy intermittency?

Answer: The Department of Energy's Wind Program works to develop much higher resolution capability for modeling and predicting output from current and future wind power plants in order to support electric utility operations and planning. The Program also supports analyses, and method and tool development that will enable grid operators and planners to reliably and most economically manage the increased variability created by addition of wind energy, in anticipation of much higher penetration levels. Major areas of focus are the improved use of wind forecasting, wider area grid management strategies, and options for maximizing the use of available grid capacity and flexibility, including assessments of the role for energy storage. The Program is supporting two large geographic footprint, high penetration wind/renewable energy integration studies - the Eastern Wind Integration and Transmission Study and the Western Wind and Solar Integration Study - that apply results from this state-of-the-art research to evaluate the impact of integrating up to 30% wind energy into the U.S. bulk power system.

The Wind Program continuously coordinates efforts with the Office of Electricity Delivery and Energy Reliability to ensure information sharing and elimination of gaps in R&D activities. The Offices have co-funded several projects aimed at reducing the costs and technical barriers to the interconnection and integration of wind energy into power systems.

21. HYDROKINETIC VERSUS CONVENTIONAL HYDROPOWER

Question: The Water Power program conducts activities on both conventional hydropower and marine hydrokinetic energy technologies. The Department has indicated that it plans to spend nearly half of the $40.5 million requested for conventional hydropower, and slightly less than that amount on marine and hydrokinetic technologies.

Noting that the Department's expertise is in developing new technologies, why are you focusing more funding on conventional hydropower, whose technologies have mature over many decades, and less funding on the emerging technologies in the untapped area of marine and hydrokinetic energy?

Answer: The Department of Energy invests in a balanced portfolio of water power technologies to meet the nation's pressing needs for renewable, sustainable energy. There are significant opportunities to increase conventional hydropower generation in the U.S., including through the development of new technologies to modernize existing facilities and develop power at non-powered dams or other small, environmentally sustainable sites. Many hydropower technologies are new and innovative such as marine and hydrokinetic devices, particularly those focused on small and "fish-friendly" hydropower systems, and government research and development can help accelerate their commercialization. As in current and previous years, the Department plans to allocate a substantial portion of its appropriation for water power towards the research, development and promotion of emerging marine and hydrokinetic technologies.

22. CONVENTIONAL HYDROPOWER RESOURCE ASSESSMENT

Question: In fiscal year 2010, the Department of Energy began a comprehensive assessment of the existing hydropower infrastructure in the United States.

In the fiscal year 2010 House bill, the Committee encouraged the Department to focus on hydropower resources not owned by Federal entities. Is this resource assessment considering only facilities not owned by the Federal government?

When does the Department expect to complete this resource assessment?

Answer: The Department is currently developing a National Hydropower Asset Assessment Program, a comprehensive assessment of the Nation's existing Federal and non-federal hydropower facilities. The Department is working closely with the U.S. Army Corps of Engineers and the Bureau of Reclamation, which own and operate approximately half of the country's hydropower capacity, to incorporate information on their facilities into this assessment and prevent any unnecessary duplication of efforts. The Department expects to complete and release this assessment by 2011.

23. STATUS OF MARINE HYDROKINETIC ENERGY TECHNOLOGIES

Question: Over the last decade, universities, industry, and government labs have experimented with a multitude approaches to harness energy in ocean tides and waves.

Has a winning technology emerged from this sea of experimentation? What is the status of the marine hydrokinetic industry?

Given the current state of this industry, what kind of work is most appropriate by the Department and most effective to advance the field?

What do you see as the current or future primary barriers to deployment for these emerging energy technologies?

Answer: While research and development in the marine and hydrokinetic energy industry increased in recent years, no single design or technology has emerged as a clear leader. Until full-scale or near full-scale demonstration projects are deployed in realistic open-water conditions, such a determination will not be made. The Department of Energy is currently working to support the design, development and testing of a variety of marine and hydrokinetic systems, and identifying key cost drivers, performance characteristics, and technology improvement opportunities.

The Department leverages its expertise in technology development to identify and fund research in areas where industry currently lacks either the capabilities or financial resources. The Department conducts research in six key areas that have been identified as critical to the success of the marine and hydrokinetic industry: 1) system development, deployment and verification to improve device functionality, to generate cost, performance and reliability data, and to test systems in relevant open-water setting; 2) research tools to develop design codes and models necessary for supporting system development and testing; 3) adequate test centers and facilities to generate and collect system data; 4) technology characterization to analyze and evaluate test data; 5) resource assessments to quantify energy availability and location; and 6) studies and projects to evaluate and minimize key environmental risks to permitting and deployment of demonstration projects.

The major barriers to the deployment of ocean energy devices include: technical risk and uncertainty regarding device cost, performance, and survivability; uncertainty associated with the duration and timing of recently developed permitting processes at both Federal and State levels; a dearth of environmental and competing-use impacts data; and a need to integrate national energy priorities within coastal and marine spatial planning processes.

24. GLOBAL COMPETITION TO HARNESS OCEAN ENERGY

Question: Some countries such as the U.K. and Ireland are investing significant fractions of their energy research and development budgets into ocean energy research, demonstration and deployment.

Is our level of investment commensurate with those countries with leading investments in marine energy technologies?

Industry proponents claim that as much as 10 percent of our nation's electricity could come from ocean energy. Is this figure overstated, or is there an opportunity to take advantage of this domestic resource?

If the ocean energy resource is so plentiful, what are the opportunities and challenges of using ocean energy to supply power to a geographic broad portion of the United States?

Answer: European nations have invested large amounts of funding towards the research and development of ocean energy technologies over the past decade. Since 2008, the Department of Energy has undertaken an aggressive ocean energy research and development program, commensurate (on a dollar basis) with those of European nations such as the United Kingdom. Certain European governments, including Spain, the United Kingdom, and the Scottish government, have invested more heavily in open water testing facilities and set aside deployment funds.

Preliminary assessments indicate that the U.S. has substantial ocean energy resources, and the Department is currently undertaking comprehensive assessments of the Nation's marine and hydrokinetic energy resources to quantify the size and assess the technical feasibility of harnessing these resources. Preliminary studies estimate that the Nation's wave resources could provide an annual average capacity of 30,000 MW; tidal resources could provide an annual average capacity of 1,600 MW; and ocean current resources, most notably the Gulf Stream, could provide 10,000 MW of average annual power.

Widespread deployment of ocean energy is part of a broad portfolio of renewable energy technologies that will help the Nation meet its pressing energy, environmental, and economic challenges. According to the National Oceanic and Atmospheric Administration, over 50 percent of the Nation's population lives in coastal counties, with this number expected to rise in the future. Ocean energy has the potential to provide these communities, many of which face the highest energy costs, with clean, renewable power. However, substantial challenges to deployment remain, including technical risk and uncertainty regarding device cost, performance, and survivability; lack of reliable policy incentives to encourage the deployment and subsequent cost-reduction of new and innovative energy technologies; lengthy permitting processes at both Federal and State levels; a dearth of environmental and competing-use impacts data; and a need to integrate national energy priorities within coastal and marine spatial planning processes.

25. COLLABORATION WITH FEDERAL WATER AGENCIES

Question: The Department of Energy has expertise in the research, development, and demonstration of hydropower and marine energy generation technologies. Water power systems, however, involve a broad array of other considerations, including regulatory barriers, resource assessments, and environmental impact.

How is the Office of Energy Efficiency and Renewable Energy collaborating with the Army Corps of Engineers and other federal agencies that have developed expertise in these other areas relevant to water power and ocean energy?

What role is the Department best suited for in these collaborations, given its background in technical research and development?

Answer: The Department of Energy works closely with the many Federal agencies that have a role in hydropower and ocean energy regulation, siting, and licensing through a number of channels to promote the responsible deployment of water power technologies. Activities include:

- On March 24, 2010, the Department signed a Memoranda of Understanding (MOU) with the U.S. Army Corps of Engineers and the Bureau of Reclamation, establishing an inland hydropower interagency working group to promote environmentally sustainable development of hydropower on federal lands, accounting for the full range of considerations relevant to hydropower generation.
- The Department participates in the Interagency Working Group on Ocean Partnerships with a number of agencies including the Minerals Management Service (MMS), FERC, NOAA, the Coast Guard, and EPA. DOE also leads the Federal Working Group on Renewable Ocean Energy.
- The Department is working with FERC and MMS to coordinate an international effort to compile and disseminate information on the environmental effects of ocean energy technologies under Annex 4 of the International Energy Agency's Implementing Agreement on Ocean Energy Systems. The Department is currently drafting an MOU with MMS regarding the deployment of marine and hydrokinetic energy, as well as offshore wind.

The Department's role in these and other collaborations is to facilitate the responsible deployment of water power technologies by providing other agencies with technical information on water power technologies; by undertaking targeted technological, environmental, regulatory, and economic research to address key knowledge gaps; by promoting water power equities in interagency interactions; and by supporting the development of technologies that contribute to these shared objectives.

26. PLUG-IN HYBRID ELECTRIC VEHICLES

Question: In the last year, several major car manufacturers have announced that they will begin selling plug-in hybrid electric vehicles commercially in 2011. At the same time, the request includes $165 million for plug-in hybrid vehicles out of $325 million for vehicles technologies.

Why does the request pour so much of the funds in the vehicle technologies program into a technology that the private sector is already rolling out?

What role is the Department playing that would not have otherwise been filled by the private sector, or how are the Department's activities accelerating advancement and adoption of this emerging technology?

Answer: Several automotive manufacturers have announced plans to produce and sell small numbers of plug-in hybrid electric vehicles (PHEVs) over the next several years. The recent interest by the private sector to proceed towards commercialization of PHEVs is partly based on technological advances, including cost reduction of high energy batteries, enabled by research and development advances supported by the Department of Energy. However, technology has only advanced to the point of allowing initial market introduction, not to the point of achieving significant market share. In order to sustain this momentum, significant advances in electric drive technology, coupled with a reduction in the cost of these components must be achieved.

The Department's R&D budget supports the development of advanced batteries and electric drive systems in order to make the next generation of PHEVs more affordable and more competitive. Without continued support from the Department, it is highly unlikely that this and other critical activities would be continued solely by the automotive industry. Furthermore, the strong competition from foreign manufacturers who are aided by their governments for this technology is also a factor in the Department's decision to support development activities that will aid American industry.

The Department's role is one of both technology development leadership and financial assistance to the industry. By providing a sustained investment in plug-in hybrid vehicle technologies, the Department sends a strong signal to the private sector that encourages further investment and development by industry. The Department demonstrates a commitment to support American industry in capturing this market by supporting activities that address both technical and non-technical barriers.

Using Recovery Act funds, the Department is making substantial investments in establishing domestic manufacturing capability and infrastructure development needed to advance the widespread market penetration of electric drive vehicles. These investments totaled over $2.5 billion, including approximately: $2 billion for battery and electric drive manufacturing facilities;

$400 million for transportation electrification demonstrations; $150 million for deployment of electric drive vehicle and charging infrastructure; and $20 million in battery research and testing facilities.

Under the Advanced Technology Vehicle Manufacturing Loan Program, the Department has made loan commitments of over $8 billion to domestic manufacturers of electric drive vehicles, including loans to Ford, Nissan, Tesla, and Fisker Automotive.

Under the Recovery Act's Section 48C Advanced Energy Manufacturing Tax Credits, the Department has made awards for tax credits for several clean energy manufacturing projects related to electric drive vehicles.

As part of the U.S. government effort to update the federal fleet with fuel efficient hybrids and PHEVs, the U.S. General Services Administration (GSA) will replace 5,603 of its least-fuel-efficient cars and trucks with fuel-efficient hybrids. DOE will lead this initiative by replacing 753 vehicles with hybrids in 2010. This will bring the total number of DOE hybrid vehicles to 888, even as the agency trims the overall size of its vehicle fleet. GSA also committed to purchasing approximately 100 PHEVs in 2011.

In addition, the Department is conducting ongoing applied R&D to support the development of critical technologies needed for widespread introduction of electric drive vehicles. These efforts include battery development, power electronics and electric motors, and electric drive vehicle systems. Similarly, the Department's deployment of charging infrastructure is accelerating the adoption of the emerging PHEV technology.

27. ADVANCED INTERNAL COMBUSTION ENGINES

Question: The Vehicle Technologies program aims to enhance battery manufacturing capacity that would increase fuel economy, lower price, and provide for 500,000 plug-in hybrid electric vehicles by 2015—an effort I fully support. But, while this may be contrary to public thought, the reality is that the traditional internal combustion engine will not be going away any time soon. So, I am curious to know what the Department has done, and will be doing, within the Advanced Combustion Engine Research and Development program.

Are you aware of any technologies that exist in the industry that might lead to an alternative internal combustion engine (ICE) architecture, but yet would still yield the desired environmental and efficiency goals?

What type of support does the Vehicle Technologies program provide to encourage new entrants to ICE manufacturing industry?

Answer: The Department is well informed regarding promising new engine architectures. Two examples of advanced engines in our portfolio are the free-piston and the variable compression ratio (VCR) engines. In order to reach high-volume sales, any new engine design must be cost-competitive, meet emissions standards, and offer fuel economy, reliability and performance comparable to today's engines. DOE conducts periodic competitive solicitations for engine efficiency improvement with proposals reviewed by expert panels. The VCR engine was, in fact, selected and funded through this process. In January 2010, the Department announced selection of nine cost-shared proposals valued at $187M; six to improve the engine efficiency for passenger vehicles by 25 to 40 percent, and three to improve the engine efficiency of commercial vehicles by 20 percent. These nine selections will be awarded this fiscal year, and include innovative technologies such as advanced combustion regimes and waste heat and energy recovery.

28. ETHANOL BLEND WALL AND INTERMEDIATE FUEL BLEND TESTING

Question: Assistant Secretary Zoi, in a hearing two weeks ago, the Secretary of Agriculture reported that there has been some indication from the Department of Energy that E15 gasoline, which contains 15 percent ethanol, is close to being approved by the federal government for use in existing gasoline vehicles. As you know, the current 10 percent limit on ethanol in gasoline blends creates a so-called "blend wall" that may limit our ability to reduce our dependence on imported oil in the short-term.

What is the status of the Department of Energy's intermediate blend testing, and do you expect E15 to be approved imminently?

When and if E15 is approved, we'll then face a new blend-wall at 15 percent ethanol. At the same time, the Department's fiscal year 2011 request does not include any funding for intermediate ethanol blend testing. Why has the Department chosen to omit any blend testing from its budget request?

Answer: The Department of Energy's intermediate ethanol blend testing program will provide partial data to EPA in June 2010 on full-useful life emissions of Tier 2 vehicles. Data on additional Tier 2 and non-Tier 2 vehicles will be provided to EPA as it is collected. DOE expects to complete data collection by November 1, 2010. In addition to emissions data, DOE will collect engine and fuel system post-mortem teardown data and will share that with EPA as it becomes available.

EPA's Assistant Administrator for the Office of Air and Radiation Gina McCarthy wrote a letter to Growth Energy, the petitioner for the E15 waiver, on November 30, 2009, indicating that data were inadequate at that time for making a decision. It is unclear whether EPA will make a decision regarding the waiver petition prior to completion of the DOE program in November 2010.

The Department is not asking for additional funding in FY 2011 because the E15 project is complete. DOE's current intermediate ethanol blends testing program includes testing of vehicles on ethanol levels up to E20 and DOE will provide EPA data to consider waiver applications up to that level.

29. LESSONS FROM RECENT ENHANCED GEOTHERMAL SYSTEMS

Question: Previous year appropriations and the Recovery Act provided funding for enhanced geothermal systems (EGS), a promising but unproven technology that hopes to generate heat and electricity in areas where conventional geothermal systems cannot operate.

What has the Department already learned about the potential and feasibility of EGS from the recent projects the Department has funded, and what are we expecting to learn from the current fleet of ongoing Department of Energy research and demonstration projects?

Answer: The Enhanced Geothermal Systems (EGS) approach to geothermal power production is potentially attractive, but it is not yet ready for large-scale commercialization and deployment. Improved scientific and engineering understanding of EGS and increased support for technology development and demonstrations are fundamental for scaling from pilot level projects to commercially viable operations. Department funded demonstration projects suggest great potential to validate the EGS concept.

In addition to EGS demonstrations, the Department's Geothermal Technologies Program (GTP) sees its investments in Component Research and Development (R&D) and analysis as a means of gaining the knowledge necessary for the successful development of EGS technology. The Department learned from past and present EGS projects that in order to reach full commercialization it is necessary to improve and develop the technologies needed to access, evaluate, manipulate, and operate EGS reservoirs. GTP's Component R&D and analysis support EGS development by improving technologies required for EGS reservoir creation, characterization, and long-term sustainability.

The Department also learned that it is imperative to demonstrate EGS in a variety of geologic conditions and depths. EGS demonstration projects have established that in order to reach full commercialization it is also necessary to: improve the knowledge base and foster greater understanding of in situ reservoir rock responses to EGS operations; develop robust computational algorithms and tools for modeling relevant coupled processes within the reservoir; develop novel remote sensing methods; and understand other fundamental issues associated with manipulation of subsurface environments.

In addition to analysis and methodology development, new suites of technological improvements are necessary for EGS to reach its full potential. Tools capable of operating in high temperature, high pressure, corrosive environments and varying rock types are critical to the success of creating and managing an EGS reservoir. DOE hopes to learn more about these tools through its existing projects. Moreover, as the understanding of EGS expands, new technology needs will also be identified.

30. CHOOSING WINNERS AND LOSERS AND THE REDUCTION TO HYDROGEN

Question: I've heard varying accounts over the years of the federal approach to energy technologies, with some arguing for a federal portfolio balanced across all energy technologies, and others arguing that the federal government should choose winning energy technologies and throws its support behind them.

To which of these two philosophies does this Administration subscribe, and how does the proposed cut to the hydrogen and fuel cell technologies program reflect the Administration's philosophy?

Answer: The Department of Energy supports a balanced portfolio of energy technologies. However, the urgency of job creation, emissions reductions and energy security warrants more emphasis on advanced vehicle technologies that are nearer term compared to hydrogen fuel cells. The Department maintains a robust effort on hydrogen and fuel cells with a FY 2011 budget request of 137 million in applied research and development, $50 million for mega-watt scale solid oxide fuel cells, and $38 million planned for the Department's Office of Basic Energy Sciences. These efforts ensure a balanced portfolio of activities, encompassing basic science, such as developing a fundamental understanding of fuel cell catalysts and applied research, development and demonstration activities to enable the widespread commercialization of hydrogen and fuel cell technologies for stationary, portable power and transportation applications.

31. FOCUS ON TRANSPORTATION VERSUS STATIONARY APPLICATIONS

Question: Does the reduction in the Hydrogen and Fuel Cell Technologies program and the remaining requested funding reflect a shift in the emphasis between transportation and stationary applications of these technologies?

Answer: The Department's Hydrogen and Fuel Cell Technologies FY 2011 budget request of $137 million does not reflect a shift in emphasis between transportation and stationary applications. The Department continues to emphasize *cross-cutting* research and development that can impact fuel cells for stationary, transportation and portable power applications. For example, catalyst cost reduction and improved membranes can accelerate the viability of fuel cells for both transportation and stationary use.

32. BARRIERS TO HYDROGEN VEHICLE TRANSPORTATION

Question: What technological barriers have been overcome in recent years, and what barriers still exist that may prevent the widespread deployment of hydrogen vehicles?

How is the Department proposing to play a role in overcoming those barriers?

Answer: The Department's hydrogen and fuel cell activities have led to significant progress in helping to overcome the barriers to widespread deployment of hydrogen vehicles. For example, the modeled high-volume cost of automotive fuel cells has been reduced by more than 75% since 2002 (from $275/kW in 2002 to $61/kW in 2009) and the demonstrated durability of fuel cells operating in real-world conditions has increased to about 2,500 hours (equivalent to 75,000 miles of driving). In 2009, stack component R&D led to a 16% increase in power density which directly impacts transportation applications and can benefit stationary, portable and auxiliary power systems. The Department has already met its near term goal of $3.00 per gallon gasoline equivalent (gge) for distributed hydrogen production from natural gas at high volumes.[4]

Key barriers still include the cost and durability of fuel cells, the cost of renewable hydrogen production, and the lack of infrastructure. DOE continues to support a comprehensive program to address the technical barriers. DOE also continues to assess infrastructure needs and options through global coordination to develop a strategic long term approach for hydrogen within the context of a portfolio of advanced vehicle technologies.

---

[4] http://www1.eere.energy.gov/hydrogenandfuelcells/accomplishments.html

33. SOLID STATE LIGHTING RESEARCH AND DEVELOPMENT

Question: The Department has done some outstanding work to develop very efficient solid state lighting technologies, both for traditional light-emitting diodes (LEDs) and the more nascent organic LED technologies. These advanced lighting technologies represent potentially enormous energy savings, including significant economic savings and greenhouse gas reductions. However, these lights are still far too expensive, and the cost must be reduced significantly before broad marketplace describing how much it will focus on LEDs and on organic LEDs moving forward, and how much funding it will devote to technology research versus research to lower manufacturing costs. At the same time, your briefing materials clearly suggest the need to enhance product development and improve manufacturing processes.

Last year, the House included $7.8 million above the request for solid-state lighting, and included report language encouraging the Department to assist EISA-compliant manufacturers and ultimately consumers to realize true energy and costs savings through the deployment of high-efficiency lighting. What has the program done to implement this House language?

Of the funding you requested for solid state lighting research and development in fiscal year 2011, how much of the funding will be directed towards LEDs and how much will directed towards organic LED research?

Of the funding you requested for the fiscal year 2011 for LEDs, what fraction will be used for research and development to lower manufacturing costs, and how much will be used for technology research and development?

How do you expect the funding division between LEDs and organic LEDs, and between technology R&D and manufacturing R&D, to evolve in the next five years?

Does the program plan to devote funding to lower organic LED manufacturing costs? If so, isn't organic LED technology for general lighting too early in its development to focus on manufacturing costs?

This topic points us to a broader issue: the Department's role in laboratory research and manufacturing. Where do you believe the Department should be putting its funds, and how is that going to best support American innovation and American manufacturing competitiveness moving forward?

Answer: The Department is furthering the science and engineering of semiconductor light emitters through a partnership based program. Interested parties (National Laboratories, universities, trade associations and industry) provide input to the annual R&D roadmaps, which note priority R&D topics and update to the performance targets (relative to the changing technology/market). These roadmaps are the source of the needs statements in the annual solicitations. Selection of projects is based upon the quality of the proposals and the funding available. All projects have a provision for U.S. based manufacturing. An overall balance of the portfolio of the R&D projects is looked for, but the R&D roadmaps and the proposals are key determinates.

Relative to FY10 House language about lowering manufacturing costs and accelerating the energy savings, R&D project awards in FY10 were made in areas of novel driver architecture, inspection and defect detection, substrate production, lithography, and component assembly. Improving performance coupled with lower production costs, as these projects may produce, will speed up energy savings.

As of January 2010, the portfolio status (based on funding) was: 63% on LED projects and 37% on OLED projects; and 33% on manufacturing projects and 67% on Core Technology and Product Development. Future portfolio breakouts are difficult to predict due to changing content of R&D roadmaps, status of technology/market, proposal quality, and funding available.

As a part of the Manufacturing R&D Roadmap, lower OLED production cost is a key focus and several tasks delineate specific actions, for which several multi-year R&D projects were awarded. Materials and architecture capabilities have matured to a point that a 102 lumen per Watt laboratory OLED devise was created in a DOE project. It is critical that the OLED manufacturing process now be linked to these material and architecture ideas to assure high performance with low cost.

34. RESEARCH AND DEVELOPMENT FOR EMERGING BUILDING TECHNOLOGIES

Question: Much of the Recovery Act funding in Energy Efficiency and Renewable Energy focuses on the deployment of energy efficiency improvements to existing buildings, in order to take advantage of some of the lowest-cost ways for our nation to reduce energy demand and save money on our energy bills. In contrast, the Emerging Technologies program within Building Technologies focuses on the next technology breakthroughs that will enable the next level of cost-effective reductions to our energy needs.

What emerging technologies could put a big dent in future buildings energy consumption, when does the Department expect these technologies will be cost-competitive, and what activities is the Department conducting to push these technologies towards these milestones?

Answer: The Department is working on a number of emerging technologies that could significantly reduce energy consumption for future buildings that may also be suitable for retrofit. These technologies include solid state lighting (SSL), highly insulating windows, water heating, and advanced Heating, Ventilation, and Air Conditioning (HVAC).

- Research activities in SSL seek devices that are twice as efficient as today's best compact fluorescents, and would cost less than $2 per kilolumen (klm) by 2015. In the area of SSL, the Department has conducted solicitations aimed at achieving certain milestones for the last several years. These solicitations address efficiency and cost reduction R&D through core technology and product development. Recently a solicitation for manufacturing has been added.

- To be cost effective, highly insulating windows (R-10) would need to cost $3 per square foot by 2020. Current activities include long-term research for R-10 windows, e.g. vacuum glazings; integration and optimization of inert gas fills, low-e coatings, and thermally improved frames; and near term market transformation for retrofit market of R-5 windows and low-e storm windows.

- Advanced residential HVAC and water heating research projects target a 50% energy reduction (relative to the Building America Benchmark) at 20% incremental cost for HVAC and $2,000 incremental system cost for water heating by 2020. Current activities for residential HVAC include air-source and ground-source integrated heat pumps (IHP), high performance cold climate heat pumps, a CO_2 HVAC assessment study, and retrofit energy efficiency opportunities and barriers for HVAC and water heating. Current activities for residential water heating include heat pump water heater (HPWH), absorption water heater, a CO_2 HPWH assessment study, and complete design and fabrication of bench scale CO_2 HPWH.

- To accelerated reaching these milestones, the Department is currently conducting a large solicitation for all emerging technologies areas with funds received under the Recovery Act.

35. BUILDING TECHNOLOGIES RESEARCH VERSUS INTEGRATION ACTIVITIES

Question: While the Emerging Technologies program focuses on the development of new, efficient building technologies, the commercial and residential integration programs largely focus on using existing technologies to reduce building energy usage.

How did the Department determine the proportion of funding devoted to the emerging technology research and development, compared to funding devoted to the residential and commercial buildings integration programs?

Does this reflect the challenge in building technologies—that the necessary technologies exist, but they are not being deployed for a variety of reasons?

Answer: The commercial and residential integrations budgets are devoted to the widespread adoption, deployment, and uptake of the emerging technologies into the construction industry. This is balanced with the need to conduct research on new advanced technologies and cost reduction research for these new technologies. Many new products have specific installation and service requirements that necessitates construction sector training, education, and best practices to see widespread adoption. These activities are supported by the integration program.

The challenge in buildings technologies reflects the following situations: the technology may not exist; the technology exists but is very costly; and the technologies exist but are not being deployed for a variety of reasons, including high cost. It is a challenge to balance the need to conduct research on new advanced technologies and cost reduction research while at the same time deploying available technologies with financial and technical barriers.

36. ENERGY STAR TRANSFER TO EPA ($300 MILLION IN STIMULUS FUNDING)

Question: Given the expertise that the Department has developed in solid state lighting, it is all the more surprising that you decided last fall to transfer the Department's Energy Star responsibilities for solid state lighting to the EPA. What was your objective when you transferred this responsibility to the EPA?

Did this transfer of Energy Star program responsibility to the EPA entail any transfer of either Department personnel resources or Department funding resources in fiscal year 2010? If so, please provide the Committee with details on these transfers.

More importantly, tell the Committee what was the authority to transfer either program responsibility or program resources to another agency without the approval of Congress?

Answer: As written in the joint letter to the Chairman of the Senate Committee on Energy and Natural Resources, dated May 19, 2009, in response to provisions in the Appliance Standards Improvement Act (S.598), DOE and EPA stated:

> *"To address the committee's concerns regarding ENERGY STAR coordination, the DOE and the EPA have been working closely, and have made significant progress in coming to a shared vision, principles and operating procedures for the ENERGY STAR program. Both agencies strongly agree on the importance of the program as an easily understood, voluntary tool that consumers can use to help guide their purchase of energy efficient products. Both agencies agree that more effective cooperation is needed and will enhance the program. Both agencies agree that differences can be settled in the most timely and effective manner through such cooperation."*

Under these premises, the two agencies worked to develop the "Memorandum of Understanding on Improving the Energy Efficiency of Products and Buildings Between The U.S. Environmental Protection Agency and The U.S. Department of Energy," dated September 30, 2009. With this document the two agencies agreed to: expand and enhance Federal energy efficiency programs to improve the efficiency of a broad set of energy-using products and improve the efficiency of the Nation's buildings; build upon the important roles of each Agency in advancing energy efficiency in products and buildings; and realign program roles and responsibilities to most effectively implement these programs and systematize coordination across the two agencies on energy efficiency so as to best utilize the expertise and resources of each agency. This programmatic consolidation brought responsibility for Energy Star brand management for all product categories, including Solid State Lighting, to the EPA, but retains the engagement of DOE's technical expertise in the development of test procedures.

No personnel or funding resources were transferred from DOE to EPA.

37. BUILDING SYSTEMS HUB AND REGIONAL INNOVATION CLUSTERS

Question: In its funding opportunity announcements for the Energy Efficient Building Systems energy innovation hub, the Department proposes to place the hub at the center of a regional innovation cluster funded by other federal agencies.

What is the rationale for placing this hub within a regional innovation cluster, unlike the other two hubs funded in the fiscal year 2010?

How will the research hub interact with the industry partners in the regional innovation cluster?

When the Department selects an applicant for the hub, will it choose a location that already has a cluster of companies focusing on building technologies, or will it choose a location that does not have a cluster but can benefit from the creation of a group of companies around the hub?

Answer: The Energy Efficient Building Systems Hub will focus on research, development, demonstration and deployment of a wide diversity of highly efficient building components and systems, catalyzing an industry-wide shift to new technologies in the near, mid, and long term. As such, it is uniquely suited to link various combinations of R&D organizations (e.g. universities, National Laboratories, etc.) with business incubators to create and/or expand a network of advanced energy technology companies that promote economic development and create jobs. Because solar fuels technologies are at an early stage of development, the Sunlight to Fuels Hub is more likely to include a greater focus on basic and exploratory research and fewer business opportunities in the near to mid term. The Nuclear Energy Hub is focused on modeling and simulation of nuclear reactors, a much narrower technology focus than buildings systems.

The Hub applicants are directed to describe in their proposal how the Hub will interact with industry partners. The Hub is expected to foster and encourage robust interaction with private industry aimed at accelerating technological innovation and reducing the barriers to movement of new technologies into the marketplace. Examples of activities include (but are not limited to) industry-sponsored research partnerships, research personnel exchanges, industry-sponsored post-doctoral or graduate fellowships, and industry-sponsored seminars and conferences. The Buildings Hub is also expected to work with cluster entities to nurture networks for economic development, business financing, and workforce development within the region.

The Department will select the Hub applicants that best meet the technical merit evaluation criteria identified in the Funding Opportunity Announcement: Scientific and Technical Merit of the Project; Qualifications of Personnel and Adequacy of Resources; Management/Integration Plan; and Technology and Innovation Transfer Plan. It is anticipated that the projects will include existing companies as Hub members and cluster partners, and will create an environment in which small businesses and start-up companies can flourish. The top tier Hub proposals will then be evaluated by the interagency review panel based on the regional innovation cluster (RIC) evaluation criteria: Demonstration of RIC Best Practices; Long-Term Economic Benefit; Commitment, Competency, and Track Record of E-RIC Personnel; Commitment to Inclusion; Commitment to Developing a Skilled Workforce; Demonstration of Environmental and Energy Security Objectives; Feasibility of the Project Budget; and Adequacy of Facilities.

38. MEASURING SUCCESS OR FAILURE OF THE BUILDING SYSTEMS HUB

Question: As we enter this year's appropriations season, the question in front of the Committee isn't whether the energy innovation hubs will further innovations in the relevant technology area. The question is whether the hubs will further innovations more than if the same level of funding was put directly into existing Department programs. To make future funding decisions, we will need to closely track the performance of these new energy innovation hubs.

How will the Department measure the performance of the Energy Efficient Buildings Systems hub?

What data is the Department collecting and systems is it putting in place before the hub is established in order to ensure that you can meaningfully measure its performance in three, five, or more years from now?

What data is the Department collecting about applicants for the energy innovation hubs, in order to measure the relative performance of applicants that do and do not receive federal funding?

Over what timeframes will the Department measure the hub's performance? When can we expect to see the first indications and measures of performance?

How will the Department measure the hub's performance compared to activities using other research and development models?

Answer: The Department will measure the performance of the Buildings Hub based on the milestones, deliverables, metrics and goals proposed by the selected Hub and finalized by the Department in the approved research and development plan. The metrics and goals will link directly to the Hub's overarching mission to develop and demonstrate practical, replicable strategies for reducing overall energy consumption in buildings. The Department will assess the progress towards the goals on an annual basis via rigorous, external peer review. The Department will also establish an Energy Innovation Hubs Oversight Board that will periodically review the progress of all of the Hubs. The Hub Oversight Board will consist of the Secretary and/or his designate, the Under Secretaries for Energy and Science, and their senior scientific/technical advisors.

Applicants are required to describe the Hub's short-, intermediate, and long-term goals in their proposal, as well as the approaches and management plan to achieve those goals. The Hub will use standard project management tools to track and measure progress towards the metrics and goals, providing detailed benchmarks over the duration of the award. The types of data to be collected will be commensurate with the benchmarks and goals identified in the approved research and development and management plans. Progress towards the goals will be assessed on an annual basis via rigorous, external peer review. DOE expects to see the first measures of performance one year after the Hub begins operations.

All Hub applicants will be evaluated based on the information provided in their proposals, measured against the evaluation criteria identified in the Funding Opportunity Announcement. Following the award, the Department will measure the performance of the selected Hub based on the milestones, deliverables, metrics and goals identified in a signed financial assistance agreement.

The Department will measure the Hub's performance using merit review processes similar to those used for other research and development activities supported by the traditional funding models. These include assessing progress on an annual basis by the described rigorous, external peer review. The Buildings Hub is expected to be the world leader in pursuing advances in basic building science and technology; develop a systems approach to whole-building integration; and address the economic, policy, and behavioral factors influencing building energy consumption.

39. BARRIERS TO DEPLOYMENT OF EFFICIENT INDUSTRIAL TECHNOLOGIES

Question: We often hear in the home energy efficiency realm that consumers don't always make the economically rational decision to pay an up-front investment that will save them money in the long-term. However, we would expect that industrial businesses would make a calculated decision to invest in energy efficiency improvements if it would save their businesses money through reduced energy bills.

Are there widespread instances of missed opportunities by industrial businesses to make cost-effective energy efficiency investments? And if so, why are these businesses failing to act, and does and should the Department's Industrial Technology program play a role in encouraging these investments?

Answer: Industrial facilities have not fully optimized energy use due to a series of reinforcing barriers that are institutional and behavioral, rather than technical. In its recent study "Unlocking Energy Efficiency in the U.S. Economy", McKinsey & Co. estimated that the missed opportunity in the U.S. industrial sector for positive net present value investments using available technology is 3.65 quadrillion Btu (end-use basis). McKinsey attributes five primary barriers for why businesses are not capturing these opportunities:

- Low awareness and attention: insufficient awareness of energy efficiency opportunities within individual facilities; organizational structures and senior management are not attuned to managing energy use.
- Elevated hurdle rates: many companies require energy efficiency investments have a 1 to 2 year payback to be implemented.
- Capital allocation decisions: energy efficiency projects must compete with other priorities for capital.
- High transaction costs: includes risk aversion and production disruptions.
- Procurement and distributor availability constraints: includes lack of product availability and focus on upfront costs rather than total cost of ownership.

The Department firmly believes the Industrial Technologies Program should be actively involved in addressing these institutional and behavioral barriers. In support of this, the Department has taken a number of actions, including:

- Expanded funding for the Save Energy Now initiative to accelerate industry adoption of technologies and practices that save energy, reduce carbon emissions, and increase U.S. competitiveness.
- Initiated the Save Energy Now LEADER partnership program to accelerate the implementation of energy-saving projects. LEADER is the only Federal program focused on reducing energy intensity (energy use per unit of output) in manufacturing operations; and requires companies to set ambitious energy-intensity reduction goals of 25% or more within 10 years.
- Continued the Industrial Assessment Center program in which 26 university-based centers provide engineering services and technical assistance to small and medium sized firms by conducting no-cost energy audits at manufacturing plants requesting

them. These centers also provide valuable training for the Nation's future clean energy workforce.

- Provided approximately $155 million in funding for industrial energy efficiency project implementation as part of the Recovery Act; funding demand for meritorious projects significantly exceeded available funding.

40. COMBINED HEAT AND POWER

Question: Combined heat and power and co-generation are yet more examples of ways to use technology that has existed for decades to stretch our existing energy supplies significantly further. However, the relatively low usage of combined heat and power systems seems like a missed opportunity. A December 2009 Department of Energy report highlighted economics, standby support requirements, private wire laws, and other factors as constraints on the deployment of additional combined heat and power project. Where is the Department putting its focus to advance combined heat and power, and how is the Department taken into consideration this and other reports to guide its investments?

Answer: The December 2008 Department of Energy Report "*Combined Heat and Power: Effective Energy Solutions for a Sustainable Future*" identified 151 GW of new CHP technical potential, which corresponds to 5.3 Quads of annual energy savings and 848 MMT of annual CO_2 reductions. The DOE CHP program structured its activities in a way to best address the barriers and needs of the CHP marketplace as identified in this report to achieve the following:

- Maximize CHP energy efficiency
- Increase CHP fuel flexibility
- Capture additional waste streams
- Expand the variety of applications

DOE's CHP program (approximately $25 million per year) leverages private-sector partners to advance and promote CHP technologies through the following major program activities:

- Research and Development - to improve CHP technical performance, reduce costs, and increase use of renewable fuels. Funded projects include cost-shared research on advanced reciprocating engine systems, component technologies, and integrated energy systems.
- Technology Deployment and Demonstrations - to reduce risk for innovative new CHP applications. Funded projects include Recovery Act-identified opportunities in CHP, district energy, and waste heat recovery.
- Market Transformation - to promote marketplace education, effective policies, and fair regulatory treatment of CHP. The Clean Heat and Power Regional Application Centers (CHP RACs) lead these activities.

41. OVERSIGHT AND ACCELERATION OF RECOVERY ACT PROGRAMS

Question: The programs represented here today received some of the largest injections of Recovery Act funding compared to the size of their regular fiscal year appropriations. In addition, programs like Weatherization, the State Energy Program, and the Energy Efficiency and Conservation Block Grants all passing funds through to state and local governments, who then implement the actual project work.

Given the amount of money at stake and the pass-through nature of these programs, how has the Department engaged in close oversight to minimize waste, fraud, and abuse, while at the same time working to accelerate these projects to create jobs, lower energy bills for Americans, and transform our energy sector as quickly as possible?

What have these programs already done to create jobs and help the economy, and what benefits can we expect moving forward in the coming months and years to create jobs and transform our economy?

Answer: In order to drive program execution and provide proper oversight of the grants awarded through the Weatherization Assistance Program (WAP), State Energy Program (SEP), and Energy Efficiency and Conservation Block Grant Program (EECBG), The Department of Energy has hired numerous personnel to serve as Project Officers for each grant recipient. The Project Officers, serve as direct liaisons between DOE HQ and each recipient. In this capacity, they provide guidance, respond to grant recipient issues and questions, track financial expenditure and project performance, and conduct both desktop and onsite monitoring. In order to address particular concerns around the implementation of the WAP, DOE is hiring additional third-party inspectors to conduct on-site inspections of home weatherization. Finally, we are continuing to expand our approach to monitoring. Upon completion of a recipient risk analysis, we will be employing a risk based approach to monitoring. This means that we consider certain factors when determining the nature, timing and extent of our reviews. When we learn of issues, we move to resolution quickly, collaborating across offices, and at times, side by side with the Inspector General's Office of Investigations.

In the first quarter of 2010, grant funding available through WAP, SEP, and EECBG provided employment for the equivalent of over 11,800 full-time employees. As of April 28th, these projects combined have injected over $1B of federal funding into the wider economy. According to estimates generated by the Council of Economic Advisors, the full expenditure of WAP, SEP, and EECBG Recovery Act funds have the potential to create almost 123,000 job-years of employment in the economy. In order to ensure that the benefit of this investment continues beyond the Recovery Act, DOE is pursuing numerous initiatives aimed at fundamentally transforming the market for energy efficiency and renewable energy. These measures will enable economic growth and accelerate the implementation of cost-effective measures that improve home energy efficiency, reduce energy use and lower greenhouse gas emissions.

42. PEAK SPENDING RATE OF RECOVERY ACT WEATHERIZATION PROGRAM

Question: The Administration intends to weatherize more than 500,000 homes with Recovery Act funds. How many homes have been weatherized to date, how many homes will be weatherized per month once the program is moving at full speed, and when do you expect the program to ramp up to this speed?

What are the remaining barriers preventing the program from moving at full speed?

Answer: The Weatherization Assistance Program (WAP) has turned the corner after facing challenges associated with growth from an average of approximately $250 million program in base annual appropriations in FY09 and FY10 to address the $5 billion made available to the program under the Recovery Act. Grantees had to learn how to incorporate Davis-Bacon provisions, enhance historic preservation review, and incorporate other policy changes to successfully implement WAP funding. Despite these initial challenges, recent production is on track for goal attainment. In June 2010, the WAP network weatherized 31,850 homes which exceeded the 30,000 monthly goal. So far, an estimated 210,000 homes have been weatherized with Recovery Act funds through August 2010.

WAP is now on track to reach the 25,000 to 30,000 per month production goal necessary to meet the Recovery Act goal of 570,000 homes weatherized by March 31, 2012. Historically, peak production for WAP is experienced during the summer months, since winter weather often hinders work in many Northern and Midwestern states. This pattern is expected to be validated by Recovery Act-funded activities during the upcoming summer.

As of Sept 14, 2010, payments for the WAP reached $ $1,495,171,386, which is 31.6 percent of formula-grant dollars obligated to grantees for the weatherization of homes. WAP now spends more than $170 million per month. Along with the District of Columbia, 16 states have spent at over 40 percent of their Recovery Act WAP and 31 states have spent over 30 percent of the funds. There are 29 states that have met grantee performance required to release the hold on the remaining 50 percent of their WAP funds. Over 13,000 jobs have been supported by Recovery Act funding for WAP in the second quarter of 2010.

While many challenges have been overcome, some barriers remain. State budget limitations separate from WAP continue have a collateral impact on the capacity of grantees to implement the program, especially in several large states. Additionally, the ramping-up of monitoring operations, both by States and by the Department, represent a significant undertaking.

43. STATE ENERGY AND BLOCK GRANT RECOVERY ACT PROGRAMS

Question: The Office of Energy Efficiency and Renewable Energy has put much of its focus in the past year on implementing its Recovery Act programs. In particular, the Department has made significant progress getting funding for the State Energy Program and the Energy Efficiency and Conservation Block Grants out the door—and yet, there is still much work to be done.

Now that nearly all of the funding for these programs has been obligated, how is the Department working with the state and local governments to accelerate projects as quickly as possible?

What remaining impediments may prevent some these projects from moving forward quickly and funds from being spent?

How quickly can we expect funds be disbursed moving forward?

Answer: The implementation of State Energy Program (SEP) projects has several phases. After the Department has obligated funding to a State, the State issues competitive RFPs, makes selections, and then awards funding. The proposed projects must then go through a National Environmental Policy Act (NEPA) determination, and then funds are obligated by the State to the subgrantee to begin the work. Depending on the type of project the project cycle may last 6 to 12 months. The subgrantee invoices during this time, and the State pays invoices and then draws down funding from DOE. Final payments to contracts are not made until all of the work has been completed and gone through appropriate inspections.

The Department is working with State governments to accelerate these processes by establishing aggressive goals for obligations, expanding DOE NEPA and procurement teams to expedite project approvals, and sharing best practices on reducing the time for project implementation and costing by the State.

Remaining impediments include project implementation actions required to:

- Ensure compliance with the NEPA, the Davis-Bacon Act, and Buy-American provisions; and
- Meet accelerating project milestones regarding invoicing by subgrantees, and internal State financial actions to "draw down" Department funds through the ASAP financial system.

The Department has established the following milestones for cumulative SEP expenditures:

- $600 million (20%) by Sep 30, 2010
- $1.55 billion (50%) by Jun 30, 2011
- $2.79 billion (90%) by Jun 30, 2012

Grantees' schedules for project implementation are often planned around the 36-month, legally-allowed project period, which, along with the subgranting/subcontracting of funds can cause delays. Eligibility issues with regard to renewable energy manufacturing and loan loss reserves also constitute spending hurdles.

To meet challenges and, above all, to accelerate costing by focusing on specific targets and troubleshooting mechanisms, the Program implemented a portfolio of responses. This portfolio included "Operation QuickDraw," an outreach program by SEP management to leading grantee officials that took place in the spring of 2010. Maintaining this emphasis on comprehensive outreach, the Program mounted QuickDraw 2 during the summer of 2010, followed by QuickDraw 3, an effort that is currently under way and which is scheduled to contact all grantees before September 30, 2010. Regular letters from the Acting Program Manager addressing costing targets and weekly calls by project officers with grantees are also contributing to the Program progress.

As of September 13, 2010, SEP payments to grantees totaled $450.5 million, or 14.7% of grantee funding.

The Department has fully obligated its funds to more than 2,300 Energy Efficiency and Conservation Block Grant (EECBG) recipients by changing and clarifying its procurement processes to enable grantees' projects to proceed more quickly. These changes and clarifications include:

- Sub-grants and Sub-contracting – All subgrantees or subcontractors receiving less than $10 million from a grantee are no longer required to have a technical review conducted by the Office of Acquisition and Financial Assistance (OAFA), DOE/EERE's procurement division. Instead, subgrantees and subcontractors receiving less than $10 million may use money now, without any further technical review. Money can be given to a subgrantee or subcontractor before the Department receives information on that entity.

- Historic Preservation – This is not a condition requiring prior approval by the Department. Grantees may spend money if they follow the process outlined below:
    a. Grantees can begin individual consultation with their State Historic Preservation Office (SHPO) immediately to get approval from SHPO for work.
    b. Grantees should try to get their SHPO to sign the Programmatic Agreement (agreement between SHPO and the Department); this gives a blanket approval and will exempt many activities from consultation with the SHPO for work on historic buildings. All SHPOs are aware of this agreement and currently 15 have been signed thus far.
    c. If a grantee concludes its activities would have no adverse effect and submits documentation to SHPO and SHPO does not respond within 30 days, then that constitutes approval and the grantee may spend money after 30 days have passed.

If a grantee receives a letter from SHPO within 30 days, then grantee may not be able to start work per the SHPO's determination.

d. Grantees or subgrantees must retain documentation of SHPO approval.

- Budget Changes – As long as there is no change in activities and no change in scope, then Contracting Officer approval is not required for any transfer of approved budget among direct cost categories and/or across activities. If a grantee zeros out an activity, this is considered a scope change.

  The Department also established aggressive but collaborative milestones to accelerate the disbursement of funds:

- Milestone 1: Obligate all funds by grantees to subrecipients, subcontractors, vendor and through internal commitments.
  To date, more than $1.4B in EECBG funds that have been "put to work" with more than 4000 projects underway as contracts with sub-recipients, subcontractors and other entities are signed. In order to build on this momentum and ensure that the program is in full swing, the Department is asking that all EECBG grantees do their part to attain the following milestone:

    - The EECBG goal is to have all funds obligated and under contract by each grantee. To date, more than half of the EECBG funds (>$1.4B) have been obligated by the cities and counties to projects that are underway.

Milestone 2: Funds drawn down from ASAP account as activities are completed, beginning with 20% by September 30, 2010: A key measure of project performance is the timely invoicing of project activities as they are completed, and the corresponding drawing down of funds. To assist grantees in preparing contracts and agreements with subgrantees and subcontractors, the Department established timelines for EECBG project completion and corresponding funds draw down. By incorporating these timelines and milestones into contracting and awards agreements, grantees will help ensure timely deployment of Recovery Act funds. The Department target for the EECBG program is for grantees to draw down funds by, or ahead of, the following milestones:

- A minimum of 20% of grantee funds drawn down by September 30, 2010,
- A minimum of 50% of grantee funds drawn down by June 30, 2011, and
- A minimum of 90% of grantee funds drawn down by June 30, 2012.

DOE is also using the "Operation Clear Path" initiative for EECBG awards and continues to communicate with awardees through letters from the Program Manager on costing targets, bi-weekly calls by project officers, weekly calls with stakeholders and targeted calls for larger grantees from Senior Program staff.

Certain challenges remain given the sheer magnitude of a new program with more than 2,300 grantees. Per DOE guidance, grantees have 36 months from date of award to spend their funds, and not all feel a sense of urgency. Upon initial application, 407 grantees representing more than $400M, requested the optional additional 120 days to develop a "strategy" before submitting full applications.

The EEECBG program generally outlays funds to cities and counties when projects are completed therefore the contractors only get paid when the work is done to specification. As a result, payments are generally a lagging indicator. These completed project outlays increased from $57M in July to $64M in August. Payments are expected to increase significantly towards the $100M monthly target, indicating that the full project portfolio is moving this fall. The EECBG team has taken the following steps to accelerate the spending impact the program while ensuring compliance with all regulatory and other responsibilities.

- Changes in procurement practices to allow recipients to access their funds
- Data-driven management protocols with aggressive milestone setting
- Extensive calls, letters and webinars from DOE staff and senior management and with stakeholder organizations
- Issuance of numerous relevant program guidance
- Increases in staff size and oversight particularly on the development of onsite monitoring mechanisms

44. ENERGY EFFICIENCY CONSERVATION BLOCK GRANT SPENDING LEVELS

Question: Congress provided $3.2 billion for an energy efficiency conservation block grant program in the stimulus. Of this, only 3% has been spent. Yet, I hear that proponents for this program are pushing for billions more.

Is the Department considering further funding for this program?

What are the obstacles that have been holding up the execution of the funded projects?

Answer: The Department did not request funding for Energy Efficiency and Conservation Block Grants (EECBG) in Fiscal Year 2011.

With over 2,300 recipients, the EECBG program has undergone an unprecedented ramp-up in program implementation. Obstacles to expeditious program implementation have included compliance with National Environmental Policy Act (NEPA) and State Historic Preservation requirements. To meet the challenges at hand, DOE set aggressive deadlines and provided expanded assistance to satisfy these requirements and ensure that funds are made available for expenditure by recipients.

In the course of the last month, recipients ramped up payments from prior periods. Furthermore, EERE anticipates that by the end of June, the vast majority of awards will have all conditions lifted. As of April 8th, 2010, $1.98 billion (73.1%) of EECBG funds have been unconditionally awarded and are available for expenditure by the recipients.

45. WAGE RATE REQUIREMENTS FOR STATE ENERGY PROGRAM AND BLOCK GRANTS

Question: What is the status of Davis-Bacon wage rate requirements for the State Energy Program and the Energy Efficiency and Conservation Block Grants under Recovery Act appropriations? Have wage rate determinations been completed for these programs, and if not, what is holding back final determinations and what is the schedule for resolution of any remaining issues?

Have weatherization wage rates been applied to comparable work under the State Energy and Block Grant programs? If not, why not?

Answer: State Energy Program (SEP) and Energy Efficiency and Conservation Block Grants (EECBG) projects using Recovery Act funds must incorporate the most current Department of Labor (DOL) Wage Determinations; the Department of Energy did not request DOL to specify Davis-Bacon wage rates for SEP or EECBG as it did for Weatherization, due to the variety of projects that are eligible under these two programs. However, weatherization wage rates are to be applied to comparable work under the SEP and EECBG programs. For example, any weatherization activities funded under these programs for multifamily homes that are four stories and less are to apply the new DOL Weatherization wage rates.

46. RECOVERY ACT ADVANCED BATTERY MANUFACTURING GRANTS

Question: The Recovery Act provided $2 billion in grants for the construction of battery manufacturing facilities in the United States. When do you expect these facilities to become operational, and how will they change the domestic manufacturing landscape for specific industry sectors?

Answer: Some of these facilities will become operational as early as third quarter of 2010 for the startup phases, with additional plants coming online through 2014. These facilities will help to directly enable the electrification of the U.S. transportation system, create thousands of new high-tech domestic jobs, and significantly reduce our dependence on foreign oil. This manufacturing activity will lower the market entry cost of plug-in hybrid electric vehicles and other electric vehicles. In addition, by establishing a domestic supply chain for this industry, this activity will reduce the risk associated with a key U.S. industry being dependent on foreign suppliers and their governments.

47. BUY AMERICA WAIVERS

Question: Could you please provide details on any Buy America waivers issued by your agency for funding provided through the Recovery Act?

Do you anticipate the issuance of any additional Buy American waivers by the Department? How are you ensuring that domestic supplies and manufacturers are not available when issuing such waivers?

Answer: Under the authority of section 1605(b) of the Recovery Act (Pub.L. 111-5), the head of a Federal department or agency may issue a "determination of inapplicability" (a waiver of the Buy American Recovery Act provisions) based on the following exceptions:

The first exception is that applying the Buy American Recovery Act provisions would be inconsistent with the public interest; or
The second exception is that the iron, steel and relevant manufactured goods are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality ("Nonavailability"); or
The third exception is that the inclusion of iron, steel, and manufactured goods produced in the United States will increase the cost of the overall project by more than 25 percent ("Unreasonable Cost").

On July 20, 2009, the Secretary of Energy delegated the authority to the Administrator and Chief Executive Officer of Bonneville Power Administration to make determinations of nonavailiability and unreasonable cost. see: http://retired.doe.doxcelerate.com/pdfs/sdoa/00-033_00B.pdf

On November 10, 2009, the Secretary of Energy delegated the authority to the Assistant Secretary for Energy Efficiency and Renewable Energy (EERE), to make all inapplicability determinations to for EERE projects funded under the Recovery Act.
see: http://retired.doe.doxcelerate.com/pdfs/sdoa/00-002_01C.pdf

Pursuant to this delegation of authority, the Assistant Secretary of EERE has issued the following two waivers:

The Assistant Secretary, EERE, determined on February 11, 2010 that LED traffic lights, arrows, and crosswalk signals; fluorescent electronic lighting ballasts (with the exception of electronic dimming ballasts for fluorescent lamps that are capable of operating the lamps below 50% of their rated light output); and screw-base and pin-base compact fluorescent lamps (with the exception of plug-in CFLs longer than 10 inches) all qualify for the "nonavailability" determination based on a lack of domestic manufacturing capacity. This determination was made after a thorough market analysis and extensive consultation with lighting industry manufacturers. The three specific exceptions to the nonavailability waivers (for traffic light housing, florescent electronic dimming ballasts, and 10-inch and longer CFLs) are evidence of the very detailed research effort undertaken to support the formulations of the nonavailability determinations made thus far.

The Assistant Secretary, EERE, determined on March 19, 2010 that application of section 1605 restrictions would be inconsistent with the public interest *only in circumstances* where the recipient of EERE Recovery Act funds has taken substantial steps to commit funds for the purchase of LED lighting (lamps, fixtures, and any supporting components) and HVAC units between February 17, 2009, and March 31, 2010.

The nationwide limited public interest waiver for these two categories of manufactured goods was intended to resolve the confusion surrounding the characterization of LED lights and HVAC units as "supply items," and thus not subject to the Recovery Act Buy American provisions. The concept of the "supply item" has its origins in the Buy American Act (41 U.S.C. 10a - 10d) and the Federal Acquisition Regulation (FAR), neither of which applies to section 1605 of the Recovery Act.

On March 31, 2010, this nationwide limited waiver of the Recovery Act Buy American provisions expired, with the exception of LED traffic lights, arrows, and crosswalk signals, which are covered by a nationwide categorical waiver based on domestic nonavailability. Hence, after March 31, 2010, EERE grantees are once again required to procure LED lighting and HVAC units from domestic manufacturers in accordance with the Recovery Act Buy American provisions. The Administrator and Chief Executive Officer of Bonneville Power Administration has not issued any waivers of the Buy American Recovery Act provisions to date.

EERE is currently reviewing over 30 waiver requests submitted by Recovery Act grant recipients based on domestic nonavailability. . EERE is investigating whether there is domestic availability. EERE will continue to collaborate with the National Institute of Standards and Technology Manufacturing Extension Partnership (MEP), and a diversity of other domestic manufacturing stakeholders, in implementing our plan to scour the domestic manufacturing landscape in search of producers before making any nonavailability determinations. EERE has developed a process to catalogue and disseminate the technical specifications for the manufactured goods being submitted for waiver considerations, in order to quickly and systematically ascertain whether or not there is domestic manufacturing capacity for these items.

The purpose of the Recovery Act Buy American provision is to support economic recovery by driving investment into the domestic manufacturing sector and recycling Recovery Act dollars within the U.S. economy. To support this potential, facilitate the implementation of section 1605 of the Recovery Act, and ensure that Recovery Act funds are deployed expeditiously, EERE is operationalizing a robust and proactive strategy to locate domestic manufacturers for the hard-to-find products sought by grantees. This strategy is outlined in a Request for Information published in *Federal Register* Vol. 75, No. 23 on Thursday, February 4 (and posted on the EERE Buy American webpage http://www1.eere.energy.gov/recovery/buy_american_provision.html), and demonstrates EERE's commitment to the fulfillment of the economic and job-creation potential of the Recovery Act Buy American provisions.

EERE has collaborated with a wide range of industry stakeholders thus far, including the National Institute of Standards and Technology Manufacturing Extension Partnership, AFL-CIO Industrial Union Council, the National Electrical Manufacturers Association, three major lighting companies (GE, Osram Sylvania, and Phillips), the IUE-CWA labor union, and many smaller manufacturers, in evaluating domestic non-availability issues.

48. $90 MILLION PROPOSED INCREASE FOR WEATHERIZATION

Question: The budget request proposes an increase of $90 million for weatherization, an increase of nearly 43% over the fiscal year 2010 appropriation. What is the rationale for this substantial increase in a fiscally constrained year, when much of the Recovery Act funding will likely be spent in fiscal year 2011?

Answer: The Weatherization Assistance Program (WAP) contributes to the Secretarial goals of reducing energy demand and creating a green workforce. Since 1976, the program has helped 6.4 million American families, resulting in an estimated average energy savings of $400 per home in 2009 while increasing the comfort and safety of their homes. The program also provides specialized training and career development opportunities to thousands of workers in the residential home energy audit and retrofit field.

Detailed Justification

(dollars in thousands)

	FY 2009	FY '10	FY 2011
Weatherization Assistance	**436,770**	**176,700**	**262,500**

WAP is one of the largest and most technically advanced residential energy retrofit providers. Funds are allocated on a formula basis and awarded to States, U.S. Territories, the District of Columbia, and Native American tribal governments to increase the energy efficiency of homes occupied by low-income families. These agencies, in turn, contract with 982 local governmental or nonprofit agencies to deliver weatherization services to low-income clients in their areas.

Weatherization service providers choose the best package of efficiency measures for each home based on a comprehensive computerized energy audit. Typical energy conservation measures include: installing insulation; sealing ducts; tuning and repairing heating and cooling systems; mitigating air infiltration; and reducing electric base load consumption. The consistent delivery of quality services is addressed through active State training and technical support programs. Grant funded training allows for the introduction advanced assessment and installation techniques and continuing professional development for workers.

The FY 2011 target is to weatherize 33,484 low-income homes. The majority of WAP funding is allocated to the States as operating funds for this purpose, i.e., for labor, materials, equipment and administrative systems. The Recovery Act increased the percentage (approximately twice as much as previous years) of the total program funding allocated for state-based training and technical assistance to maintain a high standard of technology application, effectiveness and results. Most training and technical assistance is performed at state and local levels.

Training and Technical Assistance	**13,230**	**3,300**	**7,500**

(dollars in thousands)

	FY 2009	FY '10	FY 2011
DOE directed weatherization training and technical assistance activities improve the effectiveness and efficiency of WAP. These resources support strategic planning and analysis; program performance measurement and documentation; and facilitation of (e.g., through pilot programs, publications, training programs, workshops and peer exchange) advanced techniques and collaborative strategies. An ongoing national evaluation is assessing the overall energy savings and cost-effectiveness of the program.			
Innovation in Weatherization	**0**	**30,000**	**30,000**
The objectives of the Innovation in Weatherization activity is to demonstrate new ways to increase the number of low-income homes weatherized and lower the Federal per home cost for residential energy retrofits, while also establishing a stable funding base. DOE will form partnerships with non-traditional weatherization providers such as foundations and other non-profits, labor unions, churches, private contractors, large companies, and other groups. These organizations will provide leadership in leveraging financial resources and managing the home energy retrofit process. Innovation in Weatherization contributes directly to priorities for the expansion of a green workforce and the energy retrofit of one million homes per year. A key component will be the ability of grantees to obtain $3 in non-Federal contributions for every $1 investment from DOE. This activity will build upon lessons learned from the Weatherization Innovation pilot funded in the previous fiscal year.			
Total, Weatherization Assistance Grants	**450,000**	**210,000**	**300,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Weatherization Assistance Additional funding will support the President's goal to increase the number of low-income homes weatherized.	+85,800
Technical and Training Assistance The increase will support the completion of the national program evaluation.	+4,200
Total, Weatherization Assistance Program	**+90,000**

49. WEATHERIZATION PILOT PROGRAM

Question: The fiscal year 2010 appropriations Act directed $30 million for a pilot program seeking to increase the leverage of Federal funding by the weatherization program. What is the status of this pilot program? How much of the funding has been allocated, obligated, and disbursed, and to what purposes?

How does the Department plan to continue this pilot program in 2011 with its proposed Innovations in Weatherization activity? How does the 2011 proposal build upon the pilot program activities in 2010?

How do you see results and findings from this pilot program feeding into the core weatherization program in future years?

Answer: The Funding Opportunity Announcement (FOA) for the 2010 pilot program was published on April 21, 2010. Applications were due on June 2, 2010, the Department is now conducting a formal merit review process to select grantees.

The proposed FY 2011 activity will focus on encouraging and growing more partnerships, with more participants, more innovative weatherization techniques and technologies, and more financial leveraging. The Department's goal is to build a sustainable industry in low-income weatherization that leverages Federal investment to increase the number of families served annually.

The pilot projects that the Department expects to fund will demonstrate best practices and new innovations emanating from organizations outside the traditional low-income weatherization network. The Department will evaluate the results and processes undertaken in these pilot projects in order to identify and recommend specific areas where the core program can be improved. Thus, the pilot project will constitute a feedback loop designed to expose the Department to new data points and non-traditional opinions. The Department plans to integrate any lessons learned through this process into subsequent FOAs issuances and evaluations.

50. COMPETITIVE VERSUS FORMULA GRANTS

Question: The Department proposes that half of State Energy Program funding be devoted to competitive grants and half to be distributed to the state energy offices according to a grant formula.

What is the benefit of devoting funding to competitive grants?

Does the State Energy Program competitive grants unfairly favor larger states that have the ability to compete for energy grants?

Answer: The benefits of competitive grants are:

- SEP competitive grants complement activities under SEP, while enabling DOE to direct funding to priority areas such as building retrofit financing programs, State/utility programs incentivizing utility energy efficiency investments, advanced building codes, and supporting EERE technology deployment initiatives.
- Leveraging criteria is included in evaluating competitive SEP proposals. This allows DOE to attract significantly higher levels of private investment than formula grants.
- Special Projects funds enable DOE to take advantage of the State energy office network's experience and effectiveness in deploying priority technologies and initiatives at the State and local level.

SEP Special projects selection criteria is designed to ensure that larger states are not unfairly favored.

- For example, the FY 2010 SEP competitive grants include criteria for achieving a high market penetration within the targeted market of the program proposed. This is independent of the size of the market so that small states and large States can compete on equal basis.
- The Department encourages multi-state collaboration so small States can partner with large States.
- The Department includes policy factors in award selection to ensure geographic diversity and representation of small and large States.

51. PROPOSED INCREASE FOR STATE ENERGY PROGRAM

Question: In the budget request, the Department proposes a 50% increase to funding for the State Energy Program over the fiscal year 2010. How will this funding be used during the fiscal year 2011 when much of the Recovery Act funding for the same program will be spent during that year?

Answer: All State Energy Program Recovery Act funding will be obligated by September 30, 2010. DOE estimates that over 50% of the Recovery Act SEP funds will have been expended by June 2011.

The proposed increase in the FY 2011 budget will allow for the continued focus on innovative State energy policy and programs that can attract private capital and be self-sustaining. A large percentage of the Recovery Act funds will be used for capital expenditures, whereas annual funding is likely to be used to maintain and support the critical capacity needed to manage energy programs and invest in self-sustaining programs, e.g., revolving loans, credit enhancements, and energy saving performance contracting.

52. CUES FROM ARPA-E'S APPROACH TO PROGRAM MANAGEMENT

Question: The new Advanced Research Projects Agency—Energy (ARPA-E) is getting early, positive reviews for its approach to program direction by hiring expert technical people in each technology area to serve as program directors for limited terms of around three years.

Is this an approach that the Office of Energy Efficiency and Renewable Energy (EERE) or other program officers have taken to manage its technology programs?

If not, should these offices consider the ARPA-E management model? Would the same model work across other applied research programs?

How do EERE and other offices get expert technical input with its current management structure? Do you believe that EERE's program managers generally have the latest technical knowledge on the areas they cover? Would top-tier technical experts newly out of the field be more qualified to choose areas of investment within each program that will have the most return on public investment?

Answer: Offices should always be considering innovative hiring mechanisms such as the ARPA-E model. While EERE has not adopted ARPA-E's approach, we are moving to a higher level of technical expertise more commensurate with ARPA-E and NSF standards. EERE's approach includes hiring experts under the Intergovernmental Personnel Act (IPA) mobility program. EERE aims for program managers to strike the right balance of corporate knowledge (gained by longevity in the position) and the latest technical knowledge (from not-so-distant tenures in industry or academia). As a result, we do not believe that EERE needs to restrict itself to the limited term model favored by some organizations.

53. INCREASE IN FUNDING FOR EERE PROGRAM DIRECTION

Question: Your budget for program direction for the Office of Energy Efficiency and Renewable Energy (EERE) would increase by nearly 43% to $200 million over 2010. This would be a 56% increase since fiscal year 2009, although your budget would only increase by 22% over the same period. According to your budget request, this increase is partially due to Recovery Act follow-up, requiring your staff to increase by over 50%.

With this in mind, how many people have already been hired, either as Full-Time Equivalents (FTE) or contractors?

As Recovery Act funding is expended, how many jobs are at risk? Why are you increasing the government's liability by hiring FTEs to manage the workload instead of term-employees?

Answer: The FY11 budget request will provide the appropriate level of program direction needed to manage the FY 11 program budget effectively. Unlike most other energy programs in DOE, EERE's portfolio consists of over 7,000 projects, many of them comparatively small in size. Ensuring high quality in the preparation and review of solicitations and rigorous management of existing programs requires a considerable effort.

From FY 2006 to FY 2010 the EERE budget and workload have almost doubled from $1.16B to $2.24B (93%), while Program Direction increased from $106M to $140M (37%). The budget increases provided for EERE technology programs, along with the complexity in contracts, grants, and agreements continues to present an implementation and oversight challenge for the Department.

EERE hired 236 employees for Recovery Act, of which 31 are term-employees. There are a total of 103 support contractors working on Recovery activities, 49 located in Headquarters and 54 at the Golden Field Office. All 236 Federal positions (1 year probationary period) and all 103 support contractor positions are at risk and would have to be terminated in an underfunded scenario. The 31 term-employees are at risk indefinitely.

In the past, EERE has had difficulty filling critical vacant positions. In May 2009 the direct hiring authority allowed EERE to recruit permanent personnel with broad transferable skill sets intended to backfill regular vacant positions when Recovery Act funding is expended.

54. UNFILLED VACANCIES AND RESULTS FROM 2010 FUNDING INCREASE

Question: Last year, the Office of Energy Efficiency and Renewable Energy (EERE) reported that it had approximately one hundred unfilled vacancies that had not been filled since 2006.

Has the Office of Energy Efficiency and Renewable Energy fully utilized the increase in program direction funding provided in the fiscal year 2010? How many positions to expect to remain vacant moving into fiscal year 2011?

Please provide for the record the number of unfilled vacancies in the Office of Energy Efficiency and Renewable Energy, the number of additional federal employees beyond these unfilled vacancies that the requested 2011 program direction funding level would support, and the total EERE head count once all those positions are filled.

If EERE still has substantial unfilled vacancies, what is your plan to fill these positions when EERE has been unable to fill them in the last several years, and how can you justify this year's request to increase program direction funding?

Answer: EERE has fully utilized the increase in Program Direction provided in FY 2010. EERE has cleared the backlog of vacancies for FY 2010, and does not expect to have any vacant positions moving into FY 2011. The $60 million increase in Program Direction will cover 392 FTEs needed in FY 2011, if the budget request is approved. This would bring the total EERE workforce to 1,005 FTE. EERE plans to retain the best people of the approximately 200 employees hired under the Recovery Act to partially fill the 392 FTE increase needed to effectively manage its increased workload per the FY 2011 budget request. The remaining vacancies will be filled in accordance with our hiring plan. EERE has revamped its hiring process and will not have a problem filling vacancies on a timely basis.

55. HIRING THROUGH THE GOLDEN FIELD OFFICE

Question: The Office of Energy Efficiency and Renewable Energy have been engaged in a program since October 2007 to use the Golden Field Office for recruiting and hiring and Recovery Act employees and regular employees below the GS-15 level.

How has the Golden Field Office performed in comparison to the Department's headquarters recruitment and hiring group in the Office of the Chief Human Capital Officer?

Does EERE plan to continue using the Golden Field Office hiring capability, or will it return to using Department headquarters to recruit and hire new federal employees?

Answer: The Golden Field Office has been providing recruitment services for non-Recovery Act employees in the competitive service (GS-15 and below). HC has continued to provide recruiting and hiring for employees in the Senior Executive Service, Presidential Management Fellowship, Career Intern Programs, and other special appointing authorities. In addition, the HC office continues to perform all recruitment and staffing actions for EERE HQ Recovery Act positions.

Performance by the Golden Field Office is above expectations in quality, timeliness and conforms to regulatory guidance. The combination of Golden and HC resources has facilitated EERE in hiring Recovery Act positions in an expedited manner.

EERE is planning to continue using the Golden Field Office in an expanded role. Although the streamlined recruitment and staffing model was developed and deployed in May, no open vacancy announcements have been completed, since EERE had already achieved its FY2010 hiring target -- based on the FY 2010 Appropriation. The process will resume upon receipt of the FY2011 Appropriation. Under this model, the Golden Field Office will provide services for recruitment of staffing for both Recovery Act and non-Recovery Act positions at the GS-15 level and below. Other positions will still be recruited and managed by HC. The expanded process will include hiring functions such as negotiating salary and recruitment incentives, establishing start dates, coordinating with HQ Security, processing and entering new employee paperwork into the Corporate Human Resources Information System.

This pilot will be evaluated in approximately one year by the HC office, and EERE and Golden will determine if the pilot will be extended or discontinued.

56. INCREASED FUNDING FOR STRATEGIC PRIORITIES AND IMPACT ANALYSIS

Question: The budget request increases Strategic Priorities and Impact Analysis to $27 million, $21 million above the 2010 enacted level.

How will the funding be divided among specific activities?

Please provide for the record a list of activities and planned funding levels under this item.

Answer: The proposed FY 2011 $21 million budget increase for Strategic Priorities and Impact Analysis will support a range of analytical work critical for rapid expansion of energy efficiency and renewable energy technologies. This work includes:

(1) Continued work on the Renewable Electricity Futures study which is exploring the impact of large-scale use of wind, solar, and other renewable energy technologies on a utility grid. This includes analysis of the use of demand side management and other "smart grid" technologies, new patterns of electric demand driven by plug-in hybrids and other innovations, the design and performance of the transmission system, the location and characteristics of energy storage (both central and decentralized), and other issues in comparison to conventional generation systems. This work is critical for the design of future grid systems and establishing goals for research and is in response to requirements included in Senate Report 111-39

(2) Analysis of the future of U.S. transportation taking into account innovations in vehicles and related components (engines, electric storage and drive, fuel cells, car and truck design, aircraft design, rail technology), energy sources (biomass fuels, electricity, hydrogen) and mode shifting. This work will be closely collaborated with EPA and the Department of Transportation and will be the most comprehensive to date on reducing oil use by and greenhouse gas emissions from the U.S. transportation sector.

(3) Analysis of the impact of different rates of investments in new EERE technologies on business growth and job creation, including areas such as supplies of critical materials, particularly rare earths where substantial geopolitical concerns have been raised.

(4) Development of portfolio planning and analytical tools that help emerging economies plan for expanded electrification and to develop and introduce clean energy technologies into these rapidly growing markets. This planning will provide opportunities for U.S. based companies to offer the goods and services needed by emerging economies to meet their clean energy needs. In addition to fast-growing urban areas, this work will help analyze and provide clean energy technologies to rural areas and related rural income generation and economic development.

(5) Development of improved tools and models capable of designing strategies for achieving national goals in energy and the environment that can reflect continuous advances in technology, institutional innovation driven by Federal and State policies, and the complex interactions among these factors. These tools, and requisite data, will be made available on the web for use by the public and will provide a transparent, open-source foundation for further improvements.

These efforts are a new innovative cross-cutting effort to map key pathways towards a sustainable energy future that can provide critical guidance for clean energy and energy efficiency R&D activities.

57. COMMERCIALIZATION OF INNOVATIONS

Question: The budget request increases funding for Commercialization activities within the Office of Energy Efficiency and Renewable Energy (EERE) from $7 million to over $10 million.

How will this funding be divided among the proposed commercialization activities?

Many of the challenges of commercializing technologies out of the national laboratories must be addressed with cultural and systemic shifts in the labs themselves. How will this commercialization effort in EERE integrate its activities directly with the labs, and work to systemically change the approach to getting innovations out of the labs?

Answer: Commercialization activities help ensure that EE and RE technologies move to the market quickly and at scale. These activities address a number of regulatory, institutional, and financial challenges and problems created by inadequate consumer information, lack of training opportunities in key areas, and other market failures.

New and expanded activities in FY11 will bring energy efficient and renewable technologies to the market by educating and training, improving the research and information management of EERE, and coordinating with utilities and urban strategists to deploy clean energy technologies effectively. Enhanced technology information management will ensure that EERE makes full and effective use of modern information technology to facilitate efficient operation of EERE programs and uses IT tools to make EERE information and modeling tools easily accessible to anyone needing access. Utility Integration and Urban Systems will focus on specific policy areas that shape markets for renewable energy or energy efficiency technologies and affect several program areas and will also undertake programs designed to stimulate rapid movement of concepts out of research facilities and into the marketplace by stimulating a climate of entrepreneurship around DOE supported research facilities. New commercialization activities will ensure that EERE programs are supporting work that benefits all of technologies and ensuring that best practices, analysis, and contacts are shared as appropriate.

58. RE-ENERGYSE PROPOSAL

Question: Undersecretary Johnson, you are requesting $55 million for the education initiative, RE-ENERGYSE, which Congress did not fund in the 2010 appropriations act. While I understand and agree with the critical importance of education, we had significant concerns about the redundancy of this proposal with programs in other Department of Energy offices and in other federal agencies.

We were also concerned that RE-ENERGYSE would require expertise that the Department of Energy doesn't have. The Department of Energy is primarily a research and development agency focused on energy innovations and scientific research. Other agencies, on the other hand, have decades of experience with education and workforce programs—agencies like the National Science Foundation, the Department of Education, and the Department of Labor all have this expertise.

What has changed from last year's proposal that should alter our view of this program?

What have you done to address our concerns about redundancies, and especially our concerns that the Department lack of expertise to run this program and therefore may not be the right place for it?

Answer: During the past year, the Department has worked to strengthen relationships and identify gaps with the other agencies that also conduct education and training programs - the Department of Labor (DOL), the Department of Education (ED), and the National Science Foundation (NSF). The Department also completed an analysis of all education programs within the Applied Energy Offices and the Office of Science. This study showed that, in the Applied Energy Programs, there are several small, narrowly-focused efforts that do not support cross disciplinary energy education. Additionally, there are few efforts to develop applied energy technical curricula at community colleges. The significant response to the recently announced ARRA-funded Smart Grid Workforce Training funding opportunity from community colleges and technical schools further validated this assertion[5]. RE-ENERGYSE proposed activities respond to the gaps found during the review of the Department's current programs, and are not redundant to programs currently in place.

While DOE's Office of Science has a long history and excellent track record for implementing education and training programs focused on basic science, RE-ENERGYSE will focus on applied energy sciences and engineering. The expertise in these fields lies within the Department of Energy's applied R&D programs. The FY 2011 Budget responds directly to the President's call to "scale up" Science, Technology, Engineering, and Mathematics (STEM) activities [6].

---

[5] The American Recovery and Reinvestment Act (ARRA) funded Smart Grid Workforce Training Funding Opportunity Announcement received 163 eligible applications; 54 projects were selected for funding.

RE-ENERGYSE will be closely coordinated between DOE and NSF explicitly to leverage existing resources and expertise from the two agencies. In addition to the primary DOE/ NSF relationship, DOE is consulting and working closely with ED, DOL, and the Office of Science and Technology Policy (OSTP) to achieve a strategic, integrated set of education programs.

RE-ENERGYSE will create minimal additional administration activities and plans to leverage the internal administration and operation processes and best practices already in place at DOE to the greatest degree. DOE currently administers a variety of successful education programs throughout the full DOE complex- including the Office of Science, to the National Nuclear Security Administration, and in the applied energy program offices. To ensure strong collaboration between the two offices, and to draw upon the Department's existing and successful resources, the Offices of Science and Energy Efficiency are creating one process of administration for grants and fellowships and a unified set of metrics for tracking and evaluation.

---

[6] "Preparing Our Children for the Future", Executive Office of the President and Department of Education joint press release, February 1, 2010: www.whitehouse.gov/sites/default/files/stem%2011%20final.pdf
Relevant excerpt: "$19 million in NSF and $55 million in the Department of Energy (DOE) for the RE-gaining our ENERGY Science and Engineering Edge (RE-ENERGYSE) program, located at the intersection of energy, environment, and human factors. This partnership between DOE and NSF will help the nation retain its leadership position in science and engineering by attracting and educating future scientists in the clean energy field."

59. RE-ENERGYSE INCONSISTENT WITH DEPARTMENT'S CORE EXPERTISE

Question: The Department of Energy has specific expertise in technical and scientific areas relating to energy technologies. Other federal agencies, such as the National Science Foundation and the Department of Labor, focus on education and workforce training. It seems that administering RE-ENERGYSE from within the Department of Energy would necessitate a level of expertise on educational issues not currently resident with the Department that would be redundant with expertise in other agencies.

How would the Department of Energy shore up the expertise necessary to successfully run the proposed RE-ENERGYSE program?

Can you explain the logic behind creating this redundant expertise, rather than working with other federal agencies that already have relevant experience to fill the perceived gaps in national energy education?

In the Department's proposal, how specifically would RE-ENERGYSE use the expertise resident in other federal agencies for this type of program, beyond simply talking to the other agencies from time to time?

Answer: DOE's proposed RE-ENERGYSE activities closely resemble many of NSF's education programs (Graduate Research Fellowships, Advanced Technological Education, Science Masters Program, and others) expressly to take advantage of successful program models that are already in place.

DOE currently administers a variety of successful education programs within the Office of Science, the National Nuclear Security Administration, and the Applied Energy Offices. The Office of Energy Efficiency and Renewable Energy (EERE) will assemble best practices of these programs and use existing DOE administration and evaluation infrastructure and processes. For some proposed RE-ENERGYSE activities (e.g., graduate fellowships), a joint solicitation and review with NSF may be pursued.

In addition to the resources and expertise that will be drawn upon from within DOE and NSF, RE-ENERGYSE will work closely with the Departments of Labor and Education (DOL & ED) to access their knowledge of education and technical training best practices. The relationship between DOE, DOL, and ED has been operationalized through a working Memorandum of Understanding that allows the three agencies to share information through a consulting and collaborative relationship.

60. PERFORMANCE MEASUREMENT OF THE RE-ENERYSE PROGRAM

Question: The Department's proposal for RE-ENERGYSE is intended, in large part, to increase the pool of students going into energy-related areas. This depends on the ability of the program to induce students through scholarships and fellowships to student energy-related fields.

How would the Department measure the success of the RE-ENERGYSE program? How will you measure the number of students and researchers who are induced specifically by the RE-ENERGYSE program to enter the clean energy field?

Will these scholarships and fellowships really lead more students into energy fields—will it lead students to change their whole career direction—or will this program end up giving funding to students already determined to pursue a career in energy technologies? How do you know?

Answer: The RE-ENEGYSE program intends to dedicate a small percent of funding for administration and evaluation, including rigorously designed evaluation studies that will help measure the individual program areas. These evaluation activities will help the Department measure the success of the overall program and how it helps increase the pool of students entering energy-related studies.

Formal evaluation metrics will be specifically tailored to measure the efficacy of each of the program areas: post-doctoral opportunities, graduate fellowships, undergraduate assistantships, interdisciplinary masters, Solar Decathlon, technical training grants, and K-12 and innovative outreach programs. Metrics will include the number of students trained, rates of job placement, and industry and Laboratory surveys on graduating students from programs.

Depending on the results of the formal evaluation planning efforts, specific metrics may focus on employment status, occupation, and income of recipients versus an appropriate control group. For each measure, short-term outputs, as well as long term outcomes, would be defined to ensure rigorous program evaluations and standards for measuring the impact of the federal investment.

Data collection instruments will be designed to measure the effectiveness of the fellowship or scholarship on RE-ENERGYSE participants compared to non-participants. These instruments will follow regulations set forth by the Privacy Act and Paperwork Reduction Act. A formal evaluation plan will be designed based on the Academic Competitiveness Council's *Federal STEM Education Goals and Metrics* and recommendations being developed by a new interagency effort that includes DOE, NSF, NASA, NOAA and other agencies. The evaluation plan is likely to include a wide range of data collection efforts including surveys of university majors, technical school certificate completions, participation in energy-related extra-curricular activities, and measuring the number or percentage of students who complete a STEM major.

61. THE STUDENT EXPERIENCE AND RE-ENERGYSE

Question: Currently, the National Science Foundation and some other federal agencies provide scholarships and fellowships in the areas of science, technology, mathematics, and engineering. By adding scholarship and fellowship programs in the Department of Energy's Office of Energy Efficiency and Renewable Energy and the Office of Nuclear Energy, students will face a system where the NSF and multiple offices at the Department of Energy offer separate assistance programs.

Will this web of unconnected student and research assistance programs prove difficult for students and researchers to navigate?

How will the Department ensure that the system of scholarships and fellowships is clear and easy to navigate for potential applicants?

Answer: Many funding organizations offer fellowships in the areas of science, technology, engineering, and mathematics. The National Science Foundation (NSF), National Institutes of Health (NIH), the Semiconductor Research Corporation (SRC), and the Department of Energy (DOE) represent a few. The introduction of a new graduate fellowship program specific to Energy Systems and administered by DOE should not present itself as a challenge to students trying to navigate fellowship opportunities. Moreover, through the Office of Science's education programs and the Department's extensive research programs, accessible via DOE websites, students and researchers are able to navigate the linkage between DOE and research and education opportunities.

The Department feels that it is appropriate – and desirable – for students and researchers to connect energy systems research and education opportunities with the agency that drives energy systems research and innovation- the Department of Energy.

The Department is exploring ways to streamline and consolidate Departmental education resources and opportunities. This effort will include internship, scholarship, and fellowship opportunities linked to the Office of Science, the energy programs, and the National Nuclear Security Administration (NNSA). The goal will be a single portal that is user friendly, easy to navigate, with external links to related programs at NSF and elsewhere. As part of this effort, the Department has, in coordination with NASA, NIH, USDA, NOAA, and USGS, been developing a ScienceEducation.Gov website to unify federal science agencies' science, technology, engineering and mathematics (STEM) education content, supporting cyber-learning and open participation.

62. ESTABLISHING ENERGY MAJORS AND MINORS AT UNIVERSITIES

Question: Within the RE-ENERGYSE proposal in the budget request, the Department proposes to establish two interdisciplinary clean energy masters programs at U.S. universities. With the increase in national attention on clean energy in both the public and private sectors in the last ten years, we've seen a large increase in the number of courses offered relating to energy technology and policy.

Why would we spend federal funding to establish such programs at two universities when it seems educational institutions are already trending in this direction? If the intent is to send a signal to other universities in order to start a trend, hasn't that trend already started without federal help?

What evidence do you have that a clean energy masters program is needed and beneficial?

What similar programs are offered in other countries that are not offered in the United States?

Answer: RE-ENERGYSE proposes the creation of Masters Programs, not limited to two programs/universities, in cross disciplinary Energy Management Studies to accelerate, scale-up, and focus higher education trends currently underway.

During the past decade, approximately 28 four-year colleges and universities have developed programs that are relevant to energy studies -- most of these programs focus on sustainability and environmental studies. Lawrence Berkeley National Laboratory (LBNL) estimated that these 28 programs combined only graduate 1,200 students each year.[7] Although there is a positive trend in the development of energy related programs, current programs are not specifically geared to teach cross disciplinary energy studies. In addition, these programs do not produce enough graduating students to fill existing energy occupations that require higher education. Moreover, the recently announced Smart Grid Workforce Training awards included 11 projects with universities to develop cross-disciplinary curricula focused on the clean-energy smart grid. The strong response to the funding opportunity indicates that this area is of significant interest and need.

LBNL estimates that, by 2020, energy efficiency sector professions will more than double (low scenario) and will require an additional 106,000 energy efficiency professionals[8]. Other low-carbon energy generation (wind, biomass, nuclear, solar, coal with carbon capture and storage) and transportation professions are expected to double as well, requiring an additional 300,000 energy professionals by 2020[9]. Of these 400,000-plus projected new energy jobs, at least 100,000[10] will be manager, architect, and energy engineer positions which require higher education degrees. If the Nation's programs continue to graduate 1,200 students each year, the low-carbon energy sectors will be lacking in workforce with higher education degrees by at least 88,000 by 2020[11]. The RE-ENERGYSE Interdisciplinary Masters Programs is designed to increase the pool of students graduating with energy related degrees to ensure that the U.S. is equipped with the appropriately educated and trained workforce to drive the low-carbon energy sectors of the future.

---

[7] Lawrence Berkeley National Laboratory, Energy Efficiency Services Sector: Workforce Education and Training Needs, March 2010, executive summary

[8] Lawrence Berkeley National Laboratory, Energy Efficiency Services Sector: Workforce Education and Training Needs, March 2010, executive summary

[9] Boston Consulting Group, Green Jobs for the U.S. Economy: January 27

[10] Lawrence Berkeley National Laboratory, Energy Efficiency Services Sector: Workforce Education and Training Needs, March 2010, executive summary

The LBNL study also found that demand for a workforce knowledgeable in energy systems is already outpacing supply of energy sector workforce[12], and that State budget shortages are making it more difficult for States to establish new academic programs[13].

In response to the influx of clean energy financing and an increasing demand for affordable, clean, and reliable energy, the U.S. will need an innovative and technically trained energy workforce. A multitude of studies from the Energy Information Administration, the Boston Consulting Group, Google, the Center for Energy Workforce Development, and others,[14] project that the Nation's energy systems workforce demand is expected to grow, contributing more broadly to a growth in jobs related to environmental and clean energy sectors by at least 1.8 million jobs by 2020[15], with high estimates that are closer to a 7 million[16] jobs increase by 2020. This projected growth in workforce need, coupled with the fact that as many as 40 percent of current energy systems professionals are anticipated to retire within the next 5 years[17] is of deep concern.

---

[11] "At least" because projections used from both the Boston Consulting Group Study and the Lawrence Berkeley National Lab study, represent the "Low" scenarios. The shortage of higher educated workforce could be as large as 1,000,000 when the "High" scenarios are used.

[12] Lawrence Berkeley National Laboratory, Energy Efficiency Services Sector: Workforce Education and Training Needs, March 2010, p. 33

[13] Lawrence Berkeley National Laboratory, Energy Efficiency Services Sector: Workforce Education and Training Needs, March 2010, executive summary

[14] CAP-PERI, June 2009, estimates a 1.8M net increase of green jobs by 2020 and US council of Mayors-GI, December 2008, 2.5M gross green jobs by 2028 (Boston Consulting Group Report

[15] Boston Consulting Group, Green Jobs for the U.S. Economy: January 27, 2010 (CAP-PERI, June 2009, estimates a 1.8M net increase of green jobs by 2020)

[16] Boston Consulting Group, Green Jobs for the U.S. Economy: January 27 (Google, November 2008, 7.2M net green jobs by 2030 and ASES-MISI, December 2008, 7-28M gross green jobs, very aggressive alternative energy penetration assumptions)

[17] Center for Energy Workforce Demand 2007 Report: Gaps in the Energy Workforce Pipeline, http://www.cewd.org/documents/CEWD_08Results.pdf

DOE is aware of at least six international programs relevant to Energy Systems education:

1. Delft University (Netherlands), Wind Energy Research
2. Loughborough University (United Kingdom), Center for Renewable Energy Systems Technology (CREST)
3. School for Renewable Energy Science in Iceland (Iceland), Renewable Energy Program
4. Sweden Royal Institute of Tech (Sweden), Sustainable Energy Engineering
5. University of Victoria (Canada), Institute for Integrated Energy Systems
6. The University of New South Wales (Australia), School of Photovoltaic and Renewable Energy Engineering

63. REDUNDANCIES BETWEEN RE-ENERGYSE AND OTHER AGENCIES

Question: How has the budget request for RE-ENERGYSE addressed the Committee's concern last year that much of the RE-ENERGYSE activities will be redundant with activities in other federal agencies?

How does the 2011 request for RE-ENERGYSE overlap with activities at the National Science Foundation, Department of Labor, Department of Education, and other agencies?

Answer: DOE partnered with NSF to learn about their successful track record in administering science and technology focused education and training programs, including their Advanced Technological Education (ATE), Graduate Research Fellowship (GRF), and Integrative Graduate Education and Research Traineeship (IGERT) programs, among others. Many of DOE's proposed RE-ENERGYSE programs closely resemble the structure of the NSF programs but will differ in content.

DOE's programs will focus exclusively on energy systems education, whereas NSF programs support a broad array of science and technology disciplines. In this way RE-ENERGYSE programs are not redundant with NSF programs and respond to very targeted gaps and needs in current energy education and training efforts.

Similarly, working with DOL, RE-ENERGYSE's proposed $6 million community college technical training activity will complement, rather than overlap with, DOL's "Green Jobs Innovation Fund" program. DOE recognizes that the future low-carbon energy economy workforce will require a variety of new skill sets and corresponding training opportunities. By working together, DOE and DOL will ensure that each program responds to a particular workforce training need without duplicating efforts. To this end, via an existing DOE/DOL/and Department of Education (ED) Memorandum of Understanding (MOU), DOE and DOL will consult one another while developing energy themed technical training and community college funding solicitations.

Although ED has yet to develop programs specifically focused on energy systems education, DOE and ED will work closely to advance the shared goal of improving the Nation's Science, Technology, Engineering, and Mathematics (STEM) education, to which energy systems education is closely tied. ED requested $450 million in FY 2011 to grow and improve STEM education. Their Effective Teaching and Learning and Investing in Innovation programs will focus on deepening STEM education research and methods to assess and deliver STEM materials. Operating through the DOE/ DOL/ED MOU, DOE will continue to consult and work with ED to share information while developing funding opportunities. The success of this relationship has already been shown by the fact that the Departments are working collaboratively on ED's upcoming "Educating for a Green Economy" Summit, as well as working to develop the an energy efficiency/ sustainability career pathway.

During the past year, DOE has also established strong relationships with the other education and technical training Agencies and is committed to continuing these crucial partnerships to prepare the current and upcoming generation of energy systems professionals to enter the workforce. These efforts will be coordinated through an interagency approach to ensure that current programmatic strengths are maximized while simultaneously minimizing redundancies.

64. INCONSISTENT CENTRALIZATION OF EDUCATION AND WORKFORCE PROGRAMS

Question: The proposal for RE-ENERGYSE seems like an effort to centralize education and workforce training activities at the Department of Energy under a single program. But the budget request includes many existing education and workforce training activities still embedded within the different programs, outside of RE-ENERGYSE.

Why has the Department chosen to centralize some education and workforce development activities within RE-ENERGYSE, while leaving many other similar activities embedded within various Department programs?

Please provide for the record a list of educational and workforce training activities in the Department in the 2011 budget request, including a description of the activities and amount of funding requested.

Answer: One of the key goals of RE-ENERGYSE is to coordinate education programs within DOE to maximize investment and avoid duplication. Specifically, RE-ENERGYSE will operate in the Office of Nuclear Energy (NE) and the Office of Energy Efficiency and Renewable Energy (EERE) to streamline the administration and application processes for NE and EERE's educational fellowships, grants, assistantships, scholarships, and internships. The offices will also work with the Office of Science to develop a unified set of metrics for tracking and evaluation.

The NE portion of RE-ENERGYSE (formerly Integrated University Program) and EERE's Solar Decathlon Program are included in RE-ENERGYSE FY 2011 budget proposal. The NE portion is intended to provide opportunities for any nuclear energy–related field and fits within the intent of the graduate fellowships portion of RE-ENERGYSE. The Solar Decathlon is a multidisciplinary (solar, wind, and multiple efficiency technologies) university competition that provides a national venue for students to display and test energy efficient homes on the National Mall. The remaining efforts are highly targeted: Graduate Automotive Technology Education Program (EERE), the Advanced Vehicle Competitions (EERE), and the Special Recruiting Programs run out of the Office of Fossil Energy.

65. COMPLETION OF ENERGY SYSTEMS INTEGRATION FACILITY

Question: The 2011 budget request includes $39.5 million to complete construction and procurement of research equipment for the National Renewable Energy Laboratory's Energy Systems Integration Facility (ESIF).

When can we expect ESIF to be up and running?

Will any more funding be required before the facility is fully equipped and operational?

The goals of ESIF dovetail significantly with research and development activities in the Office of Electricity Delivery and Energy Reliability (EDER). How will ESIF work with both the Office of Energy Efficiency and Renewable Energy and EDER to tackle renewable energy, smart grid, energy storage, distributions and transmission integration issues?

Answer: The ESIF will be complete and operational in December 2012. No additional funding is required as the FY 2011 funding of $39.5M will fully fund the ESIF project and provides for the equipment necessary to begin operation in December 2012. EERE is working closely with the Office of Electricity Delivery and Energy Reliability (OE) to ensure that OE's research and development needs are fully considered in ESIF design and operations. OE participated in an recent, in-depth review of the missions and associated equipment that will be undertaken in the ESIF facility in its first few years of operation. EERE expects that OE will be a user of the ESIF once completed.

66. NREL CAPITAL PLAN

Question: The National Renewable Energy Laboratory (NREL) has been building out its facilities for several years, including new office buildings, the Integrated Biorefinery Research Facility, the Energy Systems Integration Facility, and traffic and access upgrades to accommodate increase personnel volume.

What is the Department's plan for any further facilities investments in NREL in the next five years?

Answer: In the near-term, the Department of Energy (DOE) is focused on supporting its current science and infrastructure investments at NREL. To this end, DOE will seek increases in the General Plant Projects, General Purpose Equipment, and Direct Funded Maintenance in future budgets to support the $450M of new capital investment at NREL through 2012. At this time, DOE is studying future science investments at NREL but has not developed plans for any new near-term science capabilities. DOE will evaluate its strategic, supporting, and sustaining investment requirements through the normal planning and budgeting cycles.

67. WIND TECHNOLOGY TESTING CENTER

Question: With the help of Recovery Act funding, the Department established a Wind Technology Testing Center (WTTC) to test large wind turbine blades.

How will this new testing center work in conjunction with the wind testing capabilities at the National Renewable Energy Laboratory?

Do existing wind manufacturers lack their own capabilities to do this kind of testing? If large companies do have their own facilities, is this and other Department testing facility intended to help smaller companies that do not have such testing facilities?

Are this and other Department wind testing facilities geared towards increasing the competitiveness of American wind turbine manufacturers, or towards generally advancing wind turbine technology?

Answer: The Department of Energy's National Renewable Energy Laboratory (NREL) has provided technical expertise and personnel to support the design, construction, and operation of the Wind Technology Testing Center (WTTC) in Massachusetts. This new facility will complement NREL's current wind turbine blade testing facility, which is capable of testing wind turbine blades up to 50 meters long, by testing blades up to 90 meters long. The Massachusetts facility will utilize blade testing techniques developed by NREL over the last 30 years and will expand the domestic testing options for blade manufacturers. The new facility will be especially useful for the testing of large offshore wind turbine blades that are anticipated to be deployed off the East Coast in coming years.

The Department-funded testing facilities are intended to provide testing capabilities to the entire wind industry, not just to specific companies, and this fact is reflected in their business plans to become self-sustaining.

The Department is working to increase the capabilities and competitiveness of domestic wind energy equipment manufacturing through a number of initiatives, including through the operation of its two new wind turbine component testing facilities. These facilities will give U.S. companies the domestic testing capability needed to ensure the performance and reliability of their products. Certification of new wind turbine blade and drivetrain designs is crucial to ensuring the successful commercial deployment of those components. These facilities will aid in the development of a domestic supply chain for wind energy systems in the U.S.

68. ENERGY MANAGEMENT OF DEPARTMENT OF ENERGY FACILITIES

Question: The budget request includes more than $12 million for energy projects on Department of Energy facilities, under the Federal Energy Management Program.
Does the Department intend to invest in least-cost ways to reduce energy usage at Department facilities? Or does the Department plan to implement more expensive projects that demonstrate certain energy technologies?

Answer: The $12 million requested for energy management projects on Department of Energy facilities is intended to be invested to support the Department in meeting its Executive Order 13514 compliance goals. In general, the Department would invest in least-cost ways to reduce energy usage as that is the most efficacious manner in reaching compliance. The Department also has goals to meet per Executive Order 13423, the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. The Department will explore the best cost ways to meet all energy and sustainability compliance goals.

69. INCREASE FOR INTERNATIONAL COOPERATION

Question: The request increases the Office of Energy Efficiency and Renewable Energy's international cooperation program to $25 million, up from $10 million in the fiscal year 2010 and just $5 million in 2009. What prompted such a large percentage increase in the funding request for this program in this fiscal year?

Answer: EERE is requesting additional funding in FY 2011 to implement new administration and departmental initiatives, including research, development, and deployment centers in China and India. Many countries around the world are making major investments in renewable energy and energy efficiency. DOE has an enormous opportunity to learn best practices from these activities. U.S. research and industry will benefit directly from increased collaboration.

EERE international's program supports major initiatives to position the U.S. as the world leader in clean energy. By working with developing countries to aggressively pursue clean energy deployment, EERE's international investments help achieve a number of key benefits:

- Develop international clean energy markets and create demand for U.S. clean-energy technology exports.
- Accelerate clean energy innovation and reduce technology costs through R&D cooperation with International partners.
- Increase the energy efficiency of new construction in rapidly urbanizing countries, thereby avoiding long-term carbon "lock-in".
- Utilize the speed and scale of new construction to gain real-world deployment experience with new technologies.
- Assist in advancing U.S. diplomatic goals, while reducing international dependence on oil imports.
- Assist the development of standards and certification processes that ensure technical quality and create an even playing field for U.S. technologies.

In addition, increased global interest in clean energy solutions has created new opportunities for EERE to provide technical and policy assistance to key countries through a variety of bilateral and multilateral partnerships, including the Major Economies Forum. EERE also intends to consolidate and integrate international technology cooperation previously managed at the individual program levels where appropriate.

70. ISRAELI COOPERATION

Question: In the fiscal year 2010, Congress directed the Department to allocate $2 million out of the Office of Energy Efficiency and Renewable Energy's international cooperation program for the U.S.-Israel cooperation. How much does the Department plan to allocate to this program in 2011 budget request?

Answer: EERE has had good cooperation with Israel on technology cooperation over the past two years, and intends to assess needs and opportunities for future collaboration during the fourth quarter of FY 2010.

71. ENERGY ASSISTANCE FOR SMALL TRIBES

Question: The tribal energy program in the Office of Energy Efficiency and Renewable Energy provides assistance in developing energy supplies for tribes often in remote locations without cost-effective access to grid power. However, the Department focuses on assistance to large tribes, which can leave smaller tribes without any hope for receiving federal assistance through this program.

Why has the Department chosen to focus solely on assistance to large tribes?

Will the Department consider providing assistance to small tribes?

Answer: The Tribal Energy Program (TEP) is available to all of the 564 federally recognized Tribes regardless of size. The TEP's competitive solicitations are open to all Tribes, as are associated technical assistance and educational opportunities. Projects funded by the TEP have benefited Tribes ranging in size from eight members to the multi-thousand member Navajo. This base program has been in existence for decades.

Weatherization Assistance Program (WAP) money is awarded directly to the Navajo Nation in Arizona and the Northern Arapaho Tribe in Wyoming. Across the Energy Efficiency and Conservation Block Grant (EECBG) Program funded by the Recovery Act, 377 tribes, many of them small, have received direct funding.

72. ENDING FOSSIL ENERGY SUBSIDIES

Question: The Administration announced an end to fossil energy subsidies. Ending these subsidies will encourage investment in renewable technologies, according to the Administration. The Department's oil and gas research and development budgets were terminated on these grounds, coal research and development that includes private firms was not eliminated. Can you explain your logic?

Answer: Clean air is important to everyone and climate change will be a major environmental challenge for the 21st century. In September 2009, President Obama proposed and, with other G20 leaders, committed to "phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest. Inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change." Fossil Energy coal research is focused on developing technologies to reduce greenhouse gas emissions to the atmosphere from power plants by increasing operating efficiencies and improving the cost and performance of carbon capture and storage technologies. We are developing a spectrum of technologies to evolve coal into a low-carbon energy source that is economically competitive in 2020 and beyond.

Question: Many of the recipients of the oil and natural gas research funding were academic institutions and laboratories. Was it not possible to separate out the work that supported universities and the work that supported private, for-profit firms?

Answer. The decision for the Office of Fossil Energy to not request funding for oil and gas research and development is based on the nature of the research activities not the type of competitively selected awardees.

73. 10-YEAR DEPLOYMENT GOAL FOR CARBON CAPTURE AND STORAGE

Question: On February 3, the President directed that a government-wide strategy be developed in 180 days for fielding carbon sequestration technologies within ten years. The Department has requested approximately $400 million for carbon sequestration research and development. Demonstration projects are supported by $3.4 billion of Recovery Act funding. How specifically does the fiscal year 2011 budget support meeting this goal? What is the target date for commercial deployment of carbon capture and storage technologies, given the research program funded through the fiscal year 2011 request?

Answer: The approximately $400 million requested for carbon capture and storage (CCS) related research and development will support advances in capture technologies, the efficiency of advanced power generation systems, and CO_2 storage technology. Research on a variety of post combustion capture technologies will help reduce the costs of post-combustion capture to the program's target of only a 35% increase in the cost of electricity compared to a system without CCS. The development of more efficient advanced power generation systems, along with the development of advanced pre-combustion technology, aims to meet the program's goal to bring down the cost of a CCS system for the pre-combustion capture systems such that there is only a 10% increase in the cost of electricity compared to a similar system without capture. Additionally, storage research is developing the technology needed for the safe and effective permanent storage of CO_2 in the subsurface. Lower cost capture and safe and effective storage both support the President's call for a "proposed plan to overcome the barriers to the widespread, cost-effective deployment of CCS within 10 years, with a goal of bringing 5 to 10 commercial demonstration projects online by 2016."

74. CARBON CAPTURE AND STORAGE – RETROFITS V. NEW BUILD

Question: Reducing carbon emission from fossil energy plants requires both building cleaner new plants and making the existing fleet cleaner through retrofits. The request includes \$65 million for Innovations for Existing Plants, which is \$13 million above fiscal year 2010. This increase is for post-combustion research. What is your assessment of the proportion of taxpayer dollars that should be dedicated to retrofit research as opposed to cleaner new plants?

Answer: The Innovations for Existing Plants (IEP) Program supports research in advanced CO_2 capture technologies for both existing and new pulverized coal-fired power plants. The key focus areas in this program include advanced solvents, sorbents, membranes, oxy-combustion, and chemical looping. While all of these technologies could be used either as a retrofit or as a new build, oxy-combustion and chemical looping are generally considered to be better suited for new plants, whereas post-combustion capture (solvents, sorbents, and membranes) would be equally well adapted to new or existing plants.

In FY 2010, funding directed towards post-combustion capture R&D and funding devoted to oxy-combustion and chemical looping R&D was roughly equal. In FY 2011, the proportion of funding is planned to shift more heavily towards post-combustion capture, as \$20 million of the total budget will be devoted to new projects that are being selected under a FY 2010 Funding Opportunity Announcement that consists entirely of post-combustion capture technologies.

Question: Post-combustion retrofits to existing plants are expensive. Are there research and development efforts that could dramatically decrease the costs of retrofits for the existing fleet? If so, what are they?

Answer: According to the National Energy Technology Laboratory's Cost and Performance Baseline for Fossil Energy Plants report, approximately 60% of the costs associated with carbon capture and storage using a conventional amine solvent scrubber are due to plant energy losses that are necessary to operate the capture equipment. The goal of the IEP Program is to develop CO_2 capture technologies that will significantly reduce this energy penalty. Many of these technologies are in early stages of development (<0.5 MW_e pilot scale), but systems analyses have shown that these advanced capture and compression technologies all have the potential to significantly reduce energy consumption and capital costs towards the ultimate goal of a 35% increase in cost of electricity. At this time it would be premature to declare any specific technology to be the most promising.

75. BALANCING CARBON CAPTURE AND STORAGE RESEARCH

Question: Reducing carbon emissions from fossil energy plants requires both capture and storage of the emissions. The demonstration work to date has focused primarily on capturing carbon dioxide and using it in oil and gas exploration. Put another way, there are a lot of efforts to study and demonstrate capture technologies but less so for storage. The actual storage of carbon emissions in a geological structure from an operating fossil energy plant is not well understood. How does the fiscal year budget request address this inequity to ensure capture does not outpace the storage science and technologies?

Answer: CO_2 capture technology remains the most costly portion of carbon capture and storage (CCS) technology. In addition to the funding requested to support capture technology in the FY2011 request, over $130 million of approximately $400 million requested for carbon capture and storage related research and development will support storage technologies. The majority of this funding supports the Regional Carbon Sequestration Partnerships (RCSP), and their large- and small-scale injection projects. The RCSPs represent 43 states, 4 Canadian provinces, and over 350 public and private organizations collaborating on the injection of CO_2 and the understanding of the behavior of CO_2 in the subsurface. Currently the Regional Partnerships are nearing the end of Phase II, which included approximately 25 small-scale injection projects, and are now moving into Phase III, which includes 9 large-scale injection and storage demonstration projects, injecting hundreds of thousands, to a million tons of carbon dioxide each year. The lessons learned from these projects are being published in a series of Best Practice Manuals, so future CCS projects can build from the Partnerships' experience.

76. REGULATIONS AND CARBON SEQUESTRATION

Question: Other Department of Energy applied programs, like the Office of Nuclear Energy, are simultaneously working to advance technologies and the prospective licensing hurdles expected from their respective technologies. In the case of carbon sequestration there will be many regulatory hurdles to ensure these technologies are consistent with environmental laws and public health. Given the Department's background and specialty is in research and development, what is the proper role of the Department in the regulatory arena?

Answer: The proper role of the Department is to provide technical expertise and data generated through research and development to agencies with the relevant statutory authority to regulate carbon capture and storage. The Office of Fossil Energy (FE) has been working closely with the Environmental Protection Agency (EPA) in their recent efforts to develop carbon capture and storage (CCS) related regulations. FE collaborated with the Environmental Protection Agency's (EPA) Underground Injection Control Program on guidance to use existing regulatory structure to permit the Regional Partnerships' injection projects. Following this collaboration, FE has been participating in the EPA workgroup developing new regulations for CCS injection projects. In addition, FE has collaborated with EPA in their development of the Mandatory Greenhouse Gas (GHG) reporting rule for CO_2 injection facilities. This collaboration between researchers and regulators leverages the technical understanding of CCS with statutory authority to regulate CCS-related activities. On February 3, 2010, President Obama issued a memorandum establishing an interagency CCS task force, co-chaired by the Department and EPA, to identify barriers to widespread, cost effective deployment of CCS and develop a plan to "address any financial, economic, technological, legal, institutional, social, or other barriers to deployment. The Task Force [will] consider how best to coordinate existing administrative authorities and programs, including those that build international collaboration on CCS, as well as identify areas where additional administrative authority may be necessary." The Department and EPA, as well as other agencies with relevant statutory authority, are collaborating to identify these gaps and assess options to develop a comprehensive and coordinated Federal framework. Additionally, FE works with relevant state authorities to make sure they have access to the necessary expertise as they develop regulatory policy for CCS.

77. FUTUREGEN CONTRIBUTION TO RESEARCH AND DEPLOYMENT

Question: With billions of dollars of Recovery Act funding invested in carbon capture and storage demonstration programs and hundreds of millions annually supporting research, please review for the Subcommittee how the large FutureGen project will contribute to the advancement of research and deployment of capture and storage technologies? In other words, what will FutureGen provide that the other efforts funded to date will not?

Answer: FutureGen is designed to be the world's first, fully-integrated, near-zero emission coal-fueled power plant storing CO_2 in a deep saline formation. The FutureGen Alliance's Renewal Application is currently undergoing a comprehensive evaluation and a Secretarial decision is pending.

78. COST-SHARING FOSSIL ENERGY RESEARCH AND DEPLOYMENT

Question: Currently, government cost-sharing is providing an incentive for industry to advance carbon storage and capture technologies. What must happen in this technology area for industry to take the lead without government cost-sharing? More broadly, what do you see as the future role of the Department's Fossil Energy Research program in advancing the commercial deployment of Carbon Capture, Storage, and Sequestration technologies?

Answer: Wide spread CCS deployment will not occur absent a comprehensive energy and climate program that caps carbon dioxide emissions and creates a stable, long-term, market-based incentives to channel private investment in low-carbon technologies. As you note, the Department is funding a number of cost-shared projects to demonstrate the application of CCS system at scale in an integrated fashion. These projects will provide industry with data to assess the operability and reliability of these systems in order to arrive at technology for which commercial guarantees and warrantees can be made. On February 3, 2010, President Obama issued a memorandum establishing an interagency CCS task force to develop a "proposed plan to overcome the barriers to the widespread, cost-effective deployment of CCS within 10 years, with a goal of bringing 5 to 10 commercial demonstration projects online by 2016." The plan will address any financial, economic, technological, legal, institutional, social, or other barriers to deployment. The Task Force will consider how best to coordinate existing administrative authorities and programs, including those that build international collaboration on CCS, as well as identify areas where additional administrative authority may be necessary.

79. REGIONAL CARBON SEQUESTRATION PARTNERSHIPS

Question: All of the nine Regional Carbon Sequestration Partnership (RCSP) sites are planned to be injected with CO2 in fiscal year 2011. Provided this proceeds as planned, how specifically will the RCSPs contribute to the deployment of capture and storage technologies? What issues have been raised by the challenge of siting, permitting, and addressing environmental concerns for the RCSPs? What lessons have you learned?

Answer: The large-scale Regional Carbon Sequestration Partnership (RCSP) projects, through the injection of CO_2 at a commercially relevant scale, will enhance the scientific understanding of the behavior of CO_2 in the subsurface, and develop advanced monitoring, verification, and accounting techniques. This will help to facilitate the safe and effective permanent storage of CO_2 in the subsurface. The RCSP projects, as some of the earliest CO_2 injection projects, have encountered challenges and have learned many lessons that are valuable to the future widespread deployment of CCS. In a series of Best Practice Manuals, the RCSPs and NETL are publishing these lessons learned so operators of CCS projects can take advantage of the experience gained through the RCSP projects. Best Practice Manuals will be, or have been, published on the following topics: monitoring, verification and accounting; site characterization; simulation and risk assessment; well construction and closure; regulatory compliance; public education; and terrestrial sequestration practices.

80. COOPERATION WITH CHINA

Question: The fiscal year 2011 request proposes work with China in carbon capture and storage technologies through the U.S.-China Clean Energy Research Initiative. How much funding will be dedicated to this effort?

Answer: $2.5 million will be allocated to support the U.S.-China Clean Energy Research Initiative in the area of clean coal, including carbon capture and storage. A competitive solicitation will be used to obtain the support for the work of the Center. The solicitation will request matching funds from offerors. The solicitation has gone to universities, laboratories, industry, and research institutes in the United States.

Question: What specific projects and/or scope of work will comprise China-U.S. cooperation in this area?

Answer: No specific projects have yet been selected. The scope of this effort will be on clean coal, including carbon capture and storage (CCS). The CCS portion of the scope can be expected to include: low-cost capture; geologic storage technology; risk assessment; and monitoring, measuring, and verification. The work will be accomplished in the United States. The Chinese collaborative effort will leverage the United States carbon capture and storage program activity.

81. REDUCTION IN FUELS ACTIVITIES

Question: The fiscal year 2011 request for Fossil Energy R&D places highest priority on carbon sequestration, storage, and capture. This has meant a few research areas were reduced significantly, such as the $13 million reduction in Fuels research. Does slowing this research risk setting back advancements in this area?

Answer: Funding for the Fuels Program is split between two reporting levels: Hydrogen from Coal and Coal and Coal-Biomass to Liquids. Hydrogen from Coal research will focus laboratory and early engineering design studies of hydrogen production modules on applications to advance coal-fueled facilities that produce and utilize hydrogen for electricity generation. Research of the production of hydrogen for use in the transportation sector is phased-out. Similarly, no new Coal and Coal-Biomass to Liquids work will be initiated in FY2011. The decrease in funding does not slow this research or risk setting back advancements in this area.

Question: What research activities will not be conducted that would have been conducted at fiscal year 2010 levels in hydrogen from coal?

Answer: The President's FY2011 Budget requests sufficient funds to support Hydrogen from Coal laboratory and early engineering design studies of hydrogen production modules on applications to advanced coal-fueled facilities that produce and utilize hydrogen for electricity generation.

82. INCREASE IN COAL UTILIZATION SCIENCE

Question: The fiscal year 2011 request proposes $21 million in Coal Utilization Science, $10 million above fiscal year 2010. This research area involves applied, cross-cutting technologies to support low emission power plants. Please explain how this increase fits into this research portfolio's overall strategy.

Answer: This increase will initiate a multi-lab partnership to develop a comprehensive, integrated suite of computational models for accelerating the development of carbon capture technologies. The modeling and simulation-based insights will reduce the risks associated with incorporating multiple innovative technologies in carbon capture designs. The goal is to significantly reduce the development cycle required to move novel technologies to commercialization. Improved computational modeling capabilities would facilitate rapid screening of potential carbon capture technologies, a reduction in the number of scale-up projects, and more confidence in our ability to accelerate commercialization.

83. MERCURY RESEARCH REDUCTION

Question: The request includes no funding for fine particulate control research involving mercury controls. In fiscal year 2010, $2 million was provided and $5 million in fiscal year 2009. In the budget documentation, the justification for the decrease in fiscal year 2011 is to redirect resources to priority carbon capture and storage research. This would suggest the challenges surrounding fine particulate control of substances like mercury are largely resolved from a research perspective. Is this true?

Answer: There are still challenges facing the capture of mercury emissions from coal-fired power plants. However, these challenges are most appropriately addressed by industry. The resources available under the Innovations for Existing Plants Program for technology development for existing coal-fired power plants are more appropriately focused on developing advanced carbon capture and storage technology.

84. REDUCTION IN CYBER SECURITY FUNDING

Question: Last year, the President highlighted the importance of protecting our nation's systems and resources against the threat of cyber security, and protecting the nation's electric power grid was part of this effort. Ms. Hoffman, your budget request includes $30 million for cyber security for energy delivery systems, a 25% reduction from the fiscal year 2010 level. Your materials state that "capabilities of adversaries and their attack tools are outpacing our ability to defend against new attacks". With that in mind, why is your budget request decreased from last year's levels? Do you have some other indication that the threat is lessening over time?

Answer: The Department remains committed to addressing cyber security threats to ensure a secure, reliable, and modernized electricity grid. These threats continue, and the FY 2011 request supports a robust program that includes national labs, academia, utilities, and private sector vendors to enhance the cyber security of the nation's energy infrastructure, and builds on the significant progress that has already been made. For example, more than 40 hardened control systems are now deployed across the infrastructure due to DOE-industry collaborations. The funding reduction in FY 2011 reflects the successful completion of several industry-led projects and one-time funding in FY 2010 for National Electric Sector Cyber Organization required by the Energy and Water Development and Related Agencies Appropriation Act, 2010.

85. THE THREAT OF CYBER ATTACKS ON ENERGY SYSTEMS

Question: The concept of cyber attacks seems intuitive enough, but it seems less clear how the power grid is or will be susceptible to cyber attack.Does the U.S. government have a full understanding and characterization of this threat? If not, what is being done to quantify and understand the threat?

Answer: As an active member of the intelligence community, the Department continuously monitors, analyzes, and shares information on the capabilities and nature of the cyber threat. As a result, we believe we have a reasonably good understanding of the capabilities and nature of the cyber threat. That being said, it is clear "we do not know what we do not know" and there currently is no complete, integrated picture. The Department will continue to work with other U.S. government organizations and the private sector to develop a more complete picture.

Question: The Administration is investing heavily in Smart Grid and transmission technologies, including$4.5 billion in the Recovery Act. Are cyber attacks a real threat against the proper functioning of these technologies?

Answer: The Department continues to build on current research to evaluate and quantify the impact of cyber attacks on the electric power grid, including the effect of smart grid technologies. DOE has conducted numerous vulnerability assessments on the communications and control systems used to manage and monitor electric grid operations. It has also developed a modeling and simulation capability to evaluate the "end-to-end" effects of cyber attacks on the power grid and has conducted numerous analyses using plausible threat scenarios.

Like any networked electronic device, smart grid technologies are susceptible to cyber attack if not adequately protected. For this reason, the Department strongly believes that smart grid technologies should be developed with cyber security built in. Applicants for Smart Grid Investment Grants under the American Recovery and Reinvestment Act were required to include cyber security plans in their proposals and the adequacy of those plans was a key merit criterion. Successful applicants had to provide reasonable assurance that their cyber security will provide protection against broad-based systemic failures in the electric grid in the event of a cyber security breach. In addition, the Department is a key player in numerous smart grid security efforts in partnership with other government agencies and the private sector.

86. CYBER SECURITY STANDARDS AND PROTOCOLS

Question: I know that the electric grid is predominantly privately owned and operated, but national security is a federal responsibility. What standards have been established for grid cyber security, and how are we enforcing them?

Answer: Reliability and cyber security standards are currently in place for the Bulk Electric System. The cyber security standards (Critical Infrastructure Protection (CIP) standards, CIP-002 through CIP-009) have been developed by the North American Electric Reliability Corporation (NERC) and approved by the Federal Energy Regulatory Commission (FERC). These standards provide a framework for the identification and protection of critical cyber assets. The standards recognize the differing roles of each entity in the operation of the Bulk Electric System, the criticality and vulnerability of the assets needed to manage Bulk Electric System reliability, and the risks to which they are exposed. Critical Assets are identified through the application of a risk-based assessment. Asset owners that make up the standards drafting team are constantly working to improve the standards; Version 2 of the standards is now enforceable, while a Version 4 is currently in comment. Section 215 of the Federal Power Act provides the Federal Energy Regulatory Commission (FERC) with authority to oversee mandatory, enforceable reliability standards (including cyber security standards) for the bulk power system.

Question: It seems that we would need standards that clearly communicate how secure our grid must be before we can take action to improve it. How are these standards being developed?

Answer: Through the Federal Smart Grid Task Force, we are collaborating with the National Institute of Standards and Technology (NIST) and other agencies and organizations in the development of a framework and roadmap for interoperability standards, as called for in Section 1305 of the Energy Independence and Security Act. Cybersecurity is a critical element of these efforts. Our collaboration with NIST includes $10 million of Recovery Act funding that was designated to support the development and implementation of interoperability standards. The Department is supporting this effort as one of the key milestones toward realizing the goal of widespread implementation of smart grid technologies, tools, and techniques, and significant progress has been made. NIST issued Release 1.0 of the "NIST Framework and Roadmap for Smart Grid Interoperability Standards" as well as Draft NISTIR 7628, "Smart Grid Cyber Security Strategy and Requirements." These security requirements will be based on a risk assessment (including vulnerabilities, impacts, and threats) of smart grid technologies. Recognizing the importance and urgency of cybersecurity standards for the smart grid, in May 2009 the Department partnered with the UCA International Users Group (UCAIug), Consumers Energy, Florida Power & Light, and Southern California Edison and launched the Advanced Security Acceleration Project - Smart Grid (ASAP-SG) specifically to accelerate the development of cybersecurity standards for the smart grid. ASAP-SG is developing a set of security profiles, each containing a baseline set of security controls for a given smart grid application. These profiles can be used by utilities and vendors to improve the security of smart grid applications and implementations. They provide actionable guidance to utilities, vendors, and government entities on how to build cybersecurity into smart grid components in the development stage, and how to implement those safeguards when the components are integrated into the power grid. The ASAP-SG guidelines are vendor-neutral and are applicable to any smart grid architecture. Two security profiles have been completed - one that offers guidelines for securing the advanced metering infrastructure (AMI) and another that offers guidelines for securing third-party data access. A third security profile that offers guidelines for securing distribution automation systems is currently in progress. ASAP-SG is working closely with the NIST Cyber Security Coordination Task Group (CSCTG) and recently delivered the AMI security profile to be incorporated in the Draft NISTIR 7628, "Smart Grid Cyber Security Strategy and Requirements."

Question: The fiscal year 2010 Conference Report directed the Department to establish a private sector organization to coordinate private sector research and protocols for grid-related cyber security systems. How will this organization be established, and how will this organization collaborate with the federal government as it works to establish standards?

Answer: The National Electric Sector Cyber Organization (NESCO) will lay the foundation for a self-sustaining public-private partnership, bringing together domestic and international experts, developers, and users to assess and test the security of novel technology, architectures, and applications, and promote attention to infrastructure security vulnerabilities and threats. NESCO also is expected to address the priorities for development of products and deliverables to provide industry and government with the systems, and procedures to address electric sector cybersecurity challenges. This is expected to complement and enhance the development and implementation of the Roadmap to Secure Control Systems in the Energy Sector (http://www.oe.energy.gov/csroadmap.htm). It is expected that this organization will work cooperatively with the Department of Energy and other federal agencies to identify areas where the federal government can best support efforts to enhance cybersecurity of the electric sector.

The Department issued a Funding Opportunity Announcement on April 1, 2010 to seek applicants for the NESCO. The Department will award approximately $10 million over three years with cost sharing requirements over that time period. It is expected that the organization will become self-sustaining through the energy sector partnership in future years. The applicants will be evaluated based on three criteria: technical approach, partnership capabilities/organization structure, and sustainability.

Question: What are your thoughts on the proper role of the government in ensuring grid cyber security, especially since much of the data on cyber attacks is classified?

Answer: Critical infrastructure protection, both physical and cyber, is a shared responsibility between the government and the private sector. The Department has worked with the private sector for more than a decade to secure the electric grid. In its role as the sector-specific agency for the energy sector, the Department is working closely with the private sector and state/federal regulators to improve secure sharing of threat and vulnerability information and collaborate with the industry to identify and fund gaps in infrastructure research, development, and testing efforts. To align efforts and resources, in 2006 the Department facilitated the development of the *Roadmap to Secure Control Systems in the Energy Sector*, which outlines a strategic framework to develop, deploy, and maintain resilient systems that can survive intentional cyber attacks without the loss of critical functions. The Roadmap provides common goals and milestones for industry and government to work together to enhance grid cyber security. The release of the 2006 Roadmap launched an ongoing government/industry partnership to enhance cyber security across the energy infrastructure. To lead this partnership, DOE/OE formed the Energy Sector Control Systems Working Group—made up of government and industry subject-matter experts from the Energy Sector Coordinating Councils and designed to guide the implementation of the Roadmap. In September 2009, the Department again brought together leading industry stakeholders to update the Roadmap to address persistent and emerging issues. It is currently estimated that a revised version will be published in 2010. Such a coordinated industry-government approach to ensure grid security is essential for success.

87. DECREASED FUNDING FOR SUPERCONDUCTING TRANSMISSION TECHNOLOGY

Question: The budget request significantly reduces funding for High Temperature Superconducting (HTS) wires. These technologies have the potential to significantly increase the efficiency of the national grid system by reducing power lost during transmission. Why has the Department reduced funding for research and development of this technology?

Answer: The Department continues to see a role for superconductivity technology in the modernization of the grid. However, after investing over $600 million over the past 20 years, the Department believes that the HTS wire research supported by the Office of Electricity Delivery and Energy Reliability (OE) has reached a point that provides meaningful technical value and that second generation HTS wire technology developed at the DOE National Laboratories can be successfully transitioned to a U.S. manufacturing base.

Question: If the Department believes the technology has reached maturity, is it currently being deployed in the marketplace? If not, why not?

Answer: U.S. manufacturers have reached a level of maturity such that there are established facilities to produce second generation HTS wire and they are commercially selling limited quantities of wire to customers worldwide for various uses. Moreover, OE will continue to be involved in ongoing demonstration projects that incorporate HTS wire into grid applications, which include power cables, fault current limiters, and transformers. These projects were fully funded under the American Recovery and Reinvestment Act and will continue to completion through 2014. The goal of these projects is to demonstrate the value of HTS to encourage utility deployment of the technology.

Question: The budget request indicates that the Office of Science will continue working on related superconducting wire research. As the Office of Science conducts more basic research, does this imply that the Department has actually decided to take a step back to research more basic advances necessary to deploying superconducting wire technology?

Answer: DOE believes that investment in basic research can create breakthroughs and advancements that will be beneficial to superconductivity. DOE's Office of Science (SC) will support a range of fundamental research related to high temperature superconductivity. SC is involved in a number of such projects, including those aimed at developing a fundamental understanding of the phenomena that gives rise to high temperature superconductivity as well as the discovery of new superconducting materials.

88. GRID-RELATED ENERGY STORAGE RESEARCH AND DEVELOPMENT

Question: The Department proposes to increase funding for energy storage research and development in the Office of Electricity Delivery and Energy Reliability (EDER) to $40 million, up from just $4 million in the fiscal year 2009. If budget levels are an indication of priorities, then grid-related energy storage has taken a front-row seat in this year's request, even in relation to smart grid, cyber security, or transmission efficiency research. What led to your decision that energy storage is EDER's highest research priority?

Answer: All elements of the Office of Electricity Delivery and Energy Reliability's (OE) research within the FY 2011 request are important to building a modern, reliable, and secure electric grid. The request for energy storage research and development reflects an increasing and widespread awareness of the crucial importance of grid-related energy storage for grid reliability and for achieving integration of expanded renewable generation. Consistent with the Department's commitment to supporting development of clean energy alternatives, the Department believes it needs to accelerate its research efforts to achieve more progress than could be attained at current funding levels. The budget increase will fund a vigorous program of research, field evaluation, and demonstrations to maintain the momentum created by significant investment from the American Recovery and Reinvestment Act in large scale energy storage. In addition, it is important to note that energy storage is cross-cutting and an essential technology. Particularly for transportation and electricity, energy storage has emerged as a critical technology of global competitive importance. Recognizing its importance, the Department is seeking increased and focused DOE investment in storage. Success in this field is core to the DOE mission – Department-wide.

Question: What is the Department's management and implementation plan to so rapidly increase the size of this activity?

Answer: The increased funding level will in many cases allow an acceleration of research and activities that are already underway, addressing the gaps and needs that have been identified by working closely with stakeholders. Involvement with state energy offices will be expanded to allow more utilities to gain experience with storage on their systems. The OE program will also work closely with other DOE offices involved in grid-scale storage, such as Advanced Research Projects Agency-Energy, and the Offices of Science and Energy Efficiency and Renewable Energy. This will enable new research at the laboratory scale to be developed into prototypes and undergo realistic field tests to facilitate the path towards commercialization.

Question: What types of organizations will receive funding through this program—for example, universities, national laboratories, or private sector firms?

Answer: The request will encourage a wide spectrum of stakeholders to contribute to development of robust, cost effective grid storage. Universities and national laboratories will be involved in applied research on storage technologies; private industry will participate in developing prototypes with increased cycle life, energy density, and cost effectiveness; and utilities and renewable generators will provide field tests and demonstrations for a wide portfolio of technologies including systems of flow batteries, lead carbon batteries, flywheels, and compressed air energy storage.

89. TRANSFORMATIONAL EFFECT OF SMART GRID GRANTS

Question: The Recovery Act provided funding for the Smart Grid Demonstration and Investment Grant programs, implemented by the Office of Electricity Delivery and Energy Reliability. These programs have since signed contracts for nearly seventy percent of the funding allocated to these grant programs. How will these grants, which will deliver the largest deployment of smart grid technologies to date, help to transform the nation's electric power transmission and distribution system? What concrete benefits can businesses and households eventually see from the widespread deployment of these technologies?

Answer: Ms. Hoffman. We expect to witness transformational changes in two ways: 1) increased participation by consumers in how they manage their energy use, resulting in market innovation and peak demand reduction and 2) improved situational awareness and automation of the electric grid at both the transmission and distribution system levels leading to improvements in reliability and system efficiency. This transformation is expected to lead to economic and environmental benefits, which we plan to measure over the next five years.

With respect to consumer participation, smart meters combined with incentives to reduce electricity consumption (e.g., through dynamic rate tariffs) should result in reducing peak demand. There are many benefits from reducing peak demand, including the deferral or reduction of the capacity required to generate and transmit electricity, which would reduce overall system costs. The tangible benefits for consumers could eventually be improved reliability and system efficiency.

Smart meters will be coupled with devices such as in-home energy displays or energy management systems) that enable consumers to more easily adjust their electricity usage to respond to price levels and changes throughout the day. The evolution of products that help manage electricity consumption, including smart appliances and devices, will provide a rich source of market innovation in the future. In addition, at the consumer level, such automated metering infrastructure has the potential to greatly enhance the adoption of plug-in electric vehicles, while at the distribution level, it will contribute to the integration of distributed and renewable energy resources by enabling the two-way flow of information and electricity.
The deployment of smart grid technology within transmission and distribution systems will involve the utilization of sensors, switches, communications devices, and methods to interpret and respond to data. The technology will permit grid operators to better understand and react to system conditions. Tangible benefits include the ability to monitor and mitigate stresses on equipment, readily locate and isolate faults, improve response and restoration times associated with grid disturbances and failures, and operate transmission systems at their optimal limits. These capabilities will improve reliability, enhance utilization of existing assets and reduce operations and maintenance costs, which should result in fewer losses due to outages. We also expect to see a transformation in the utility workforce, as workers skilled in information technology and systems analysis will be required.

Question: When can Americans expect to see the results of these grants through lower energy bills and reduced demand on electric power generation?

Answer: The installment of smart grid technology funded through Recovery Act grants will take place during the first three years of the projects and should be completed by the end of FY 2012. We expect to witness peak demand reductions after that timeframe and hope to see improvements in system operations within the five-year term of the projects. It is difficult to predict the magnitude and timing of the benefits as utilities will have to adjust their business practices to fully utilize the technology.

Question: The Smart Grid grant program has had minor criticism that some technologies will put utilities in control of households' home appliances. Is there any merit to these concerns that smart grid technologies will "invade" our homes and take away control over our own heating, cooling, and home appliances? Were any consumers forced to accept these technologies and lose control of their own home appliances? Are there legitimate concerns to personal privacy?

Answer: The Smart Grid technologies being installed as a result of the Smart Grid grants that involve the control of devices such as thermostats or hot water heaters in the home require the consent of the home owner. Programs that leverage these technologies feature an "opt-in", and are complemented with rate-based or rebate style incentives to encourage enrollment. These programs most often seek to reduce peak load by changing consumer habits and can be mutually beneficial to the consumer and the utility. Smart Appliances such as refrigerators, washers and dryers are generally supplied with information about the price of energy via a communications path, and the customer chooses how the appliance should respond.

Energy information is a matter of privacy, and the greater the amount of information, the greater the privacy concern. Currently state regulators have jurisdiction over ownership of customer data. All utilities that bill consumers today handle personal information, and are obligated to protect it as a matter of law and public trust. In the Smart Grid, the issue of privacy is broader in that information is collected more often, potentially in much greater detail and through communication networks outside the walls of a secured data center. Award recipients are required to submit a Cyber Security Plan as part of the acceptance process, and the plan addresses the maintenance of confidentiality and integrity of information and control systems involved in the project. Consumer privacy is a beneficiary of these security measures.

90. REMAINING CHALLENGES FOR RECOVERY ACT SMART GRID GRANTS

Question: Last week, the Department of Energy announced the resolution of a taxation issue with smart grid grants that could have presented a barrier to moving forward the grants. What other barriers remain that could slow implementation of the selected projects, and how is the Department working to quickly address these issues?

Answer: The Department believes the taxation issue was the last remaining policy issue needing to be addressed. We are proceeding with finalizing awards. DOE will continue to work with all grant recipients to address any remaining technical and financial issues, rapidly make final awards, begin implementation of work, and expedite costing of funds.

91. PERFORMANCE OF HEADQUARTERS HIRING OFFICE

Question: This Committee expressed concern last year about the hiring capabilities of the Office of the Chief Human Capital Officer. The Office of Electricity Delivery and Energy Reliability (EDER) has had some hiring needs between Recovery Act funding and increased funding to regular fiscal year program direction. Have you been able to hire all staff vacancies in EDER? If not, was this due to underperformance of the Department's headquarters hiring office, or due to other factors?

Answer: We have and continue to work closely with the Department's Office of Human Capital (HC) to fill the many needed positions as quick as possible, with priority given to positions supporting the implementation of programs funded under the 2009 American Recovery and Reinvestment Act. To date, we have hired 13 of the estimated 14 Recovery support positions at Headquarters and at the same time filled another eight permanent positions over the last 18 months to help manage base program activities. The limited hiring authority provided to the Office of Electricity Delivery and Energy Reliability under the Recovery Act helped to accelerate the hiring process for Recovery hires. In collaboration with HC, we continue to find ways to further streamline and accelerate the hiring process.

92. MANAGEMENT EFFORTS TO BREAKDOWN SILOS

Question: Undersecretary Johnson, we've been hearing for many years that the program offices at the Department of Energy have suffered from a "stovepipe" culture, where conversations don't happen across technology offices, and conversations don't happen across basic and applied research activities. The real opportunity to bridge the gap between basic and applied research is lost when our own basic and applied offices don't talk to each other or collaborate.

I commend you for instituting regular Assistant Secretary and Lab director meetings. What other reforms are you putting in place to break down the stovepipes not just at the executive level, but throughout the Department?

Answer: My office is also leading a Research and Development Management Reform Initiative within the Energy program offices, with the goal of providing increased transparency of the financial and performance management of the R&D enterprise. This effort has brought together the Energy program offices and offices within the Office of the Chief Financial Officer, to develop an approach to improved management of the R&D enterprise. An outcome of this reform initiative has been increased knowledge sharing and collaboration on the processes and tools used for R&D financial and performance management, as well as leveraging of existing information technology capabilities.

Question: How are you increasing collaboration between program offices for energy areas like biofuels and solar research, for example, which occur in both the basic and applied programs?

Answer: The DOE Office of Energy Efficiency and Renewable Energy (EERE) Programs, such as the Solar Energy Technologies Program and the Office of the Biomass Program (OBP), emphasize collaboration both within EERE and across the Department, including the Office of Science (SC), the newly formed ARPA-E, and the Office of Fossil Energy.

Collaboration with the Office of Science facilitates the development of key sciences and new technical tools to advance the energy missions of DOE. For example, through regularly scheduled quarterly SC/EERE liaison meetings on biofuels, and through participation at each other's conferences, workshops, and peer-review events, the Programs share information and accomplishments and discuss barriers. The Biomass Program has collaborated with SC's Biological and Environmental Research (BER) in multiple peer reviews, and in tracking the progress of the Bioenergy Research Centers. This has led to the recent announcement of a Process Development Unit to be built by EERE at Lawrence Berkeley National Laboratory to accelerate the transition of the Bioenergy Research Centers' technologies to market. Staff from EERE have been invited by SC's Basic Energy Sciences (BES) to participate in strategic planning activities (e.g., Basic Research Needs for Solar Energy Utilization), program meetings, and peer reviews, including their recent participation on the Hub Review Team to bring their expertise to selection of Hubs for Direct Solar Fuels. In addition, a BES technical staff member is detailed part time to the EERE Solar Energy Technologies program to promote further communication and program coordination. Other examples of collaboration include working on Roadmap exercises, including the 2005 joint research agenda document titled, "Breaking the Biological Barriers to Cellulosic Ethanol,"[18] and the upcoming National Academy of Sciences report on the "Economic and Environmental Impacts of Increasing Biofuel Production."[19] The Biomass Program's recent Biomass 2010 conference highlighted a track focused on the bridge covering basic and applied research with sessions chaired by program managers from BER and BES and with presentations from BRCs, EFRCs, SC user facilities, and others.

OBP and BER also participate together on the Feedstock Production Interagency Working Group, established by the Biomass Research and Development Board. In this capacity, both offices work with other Federal agencies to identify areas of research related to biomass feedstock production in order to eliminate gaps and overlap between offices and agencies, as well as to establish a Federal plan to address research needs. OBP and BER also work together on other Interagency Working Groups established by the Board, including Biomass Conversion and Sustainability. Additionally, both DOE offices are planning to meet with EPA to provide Departmental input to the EISA-mandated Biofuel Report to Congress on the environmental impacts of the Renewable Fuel Standard. Topics on which the offices and agencies will coordinate include biofuel technologies, emerging feedstocks and conversion technologies, and indicators for environmental impacts of feedstock and biofuels production.

Beyond collaboration through meetings, working groups, and reports, EERE and SC collaborate to identify and fund meritorious projects. Furthermore, a number of key DOE National Laboratory researchers active in this biomass arena currently receive support from both the Office of Science and EERE. OBP and BER are consulting on the development of web- and GIS-based data management systems to facilitate information-sharing not only across Departmental offices and Federal agencies, but across the entire bioenergy community. OBP is developing the Bioenergy Knowledge Discovery Framework and BER is developing the Systems Biology Knowledgebase.

In addition to robust collaboration with the Office of Science, OBP has also developed a good working relationship with the newly formed ARPA-E, helping Program Directors find merit reviewers and participating at their workshops. OBP also consults with the Office of Fossil Energy due to a mutual R&D interest on the beneficial use of algae, including at least one industry partner who is receiving funds from both Offices for work on carbon dioxide re-use and recycling and biofuels production. Meaningful collaboration already exists between EERE programs, and areas of increased cooperation are currently being explored. For example, the Solar Technologies Program is considering potential ways to work more closely with other programs in the areas of biofuels and hydrogen, and OBP will continue to work closely with the Vehicle Technologies Program to support ongoing research on biofuels.

---

[18] http://genomicscience.energy.gov/biofuels/b2bworkshop.shtml

[19] http://www8.nationalacademies.org/cp/projectview.aspx?key=49174

93. CLEAN ENERGY COMPETITION WITH CHINA

Question: Secretary Chu has stated several times that China is moving forward quickly and aggressively to advance its clean-tech industry, and that we must act to hold our leadership in the emerging clean energy industries.

How much funding does the Department include in the fiscal year 2011 budget request for cooperative applied R&D programs with China? In what programs and for what purposes are these collaborations included?

We've seen recently an increasing number of American companies partnering with Chinese firms and institutions on energy projects, and more Chinese companies engaging in energy projects in the United States. What advantages, in your opinion, does China over the United States to attract clean tech investments, and what advantages does the U.S. have?

Answer: Three Program Offices at the Department have cooperative programs with China. Details of these cooperative programs are given below:

Office of Energy Efficiency and Renewable Energy:
Approximately $10 million will be allocated to support the following research and development activities:

- Joint research and development through the U.S.-China Clean Energy Research Center, focusing on electric vehicles and building energy efficiency;
- Implementation of the U.S.-China Renewable Energy Partnership, including renewable resource assessments and cooperation on grid integration, standards, testing, and certification;
- Implementation of the U.S.-China Ten Year Energy and Environment Cooperation Framework, including cooperation on building codes, appliance and materials standards, testing, and labeling;
- Cooperation on industrial energy efficiency, including plant assessment, access to financing (e.g., helping industrial facility managers explore various methods of financing retrofits, including through energy service companies), and training and outreach materials; and
- Cooperation on transportation technologies, including biofuel research and development and electric drive vehicle deployment.

Office of Fossil Energy:
Approximately $2.5 million will be allocated to support the carbon capture and sequestration (CCS) portion of the U.S.-China Clean Energy Research Center with the following focuses:

- Capture technology, with an emphasis on post-combustion CO2 capture;
- Storage, use and transport, including: geologic storage capacity estimates, identification and assessment of sources and sinks of CO2, and techniques for monitoring, verifying, and accounting;
- Integrating plants with CCS, focusing on efficiency and costs; and

- Risk assessment and simulation, including risk assessment methodologies, simulations of CO2 behavior during storage, and plant simulations.

Office of Nuclear Energy:
China is collaborating with the United States and other countries on research and development of Very High Temperature Reactor systems via the Generation IV International Forum. China is also constructing a gas-cooled pebble bed modular reactor that is substantially similar to one of the designs being considered for the Next Generation Nuclear Plant. China has offered to provide information on their gas-cooled reactor experience through the Generation IV International Forum activities.

For clean technology investors, China is attractive for four primary reasons: 1) a growing domestic market, 2) lower costs, 3) policy incentives (e.g., low interest loans, subsidies, etc.), and 4) faster implementation of large-scale projects. The advantages to investors in the United States are: 1) protected and dynamic environment for innovation, 2) strong R&D infrastructure, 3) mature clean energy technology market, and 4) transparent laws and regulations.

94. BATTERIES AND ENERGY STORAGE RESEARCH AND DEVELOPMENT

Question: Research and development for batteries and energy storage provides a good case study for research overlap across program offices and the opportunity for collaboration and coordination. Several program offices, including the Office of Energy Efficiency and Renewable Energy (EERE), Office of Electricity Delivery and Energy Reliability (EDER), Advanced Research Projects Agency—Energy (ARPA-E), and Office of Science, request funding for energy storage research and development. In a Department where program offices historically have not communicated with each other, there are significant concerns that these program offices are funding redundant activities.

Undersecretary Johnson, how is the Department ensuring that the energy storage activities across these four program offices are complementary, rather than redundant? How do the requests from each of these programs overlap?

The subcommittee was briefed on the overall program earlier this week. While each program was able to discuss how they developed the budgets for their programs, no one could articulate whether there was a Department-wide investment strategy. How did the Department determine the relative funding levels for these different activities—$40 million for grid-scale energy storage in EDER, $25 million for renewable energy storage in EERE, $94 million for hybrid electric vehicle energy storage in EERE, $51 million for basic research in Science, and an undetermined amount in ARPA-E? For example, is the hybrid vehicle storage problem more than twice as important as the grid-scale storage problem?

How are Department managers working to ensure communication among all involved staff and all involved researchers funded by these activities? How are these programs coordinated?

Answer: The Department has formed an Energy Storage Principals Working Group consisting of senior leadership of the offices noted above, as well as the Loan Guarantee Program Office. A staff level working group meets more frequently to coordinate day-to-day activities. The program offices share detailed project listings and participate in review of each other's new and ongoing projects. They also share information on upcoming Funding Opportunity Announcements and support joint workshops to identify gaps and barriers.

This work is ongoing along with the R&D Enterprise Management Working Group to better assess technology readiness and funding across programs.

It is important to note that energy storage consists of many different technologies for many different applications. Each program office supports projects consistent with its mission and the stage of technology development. Funding levels for each program are developed to be consistent with each program's long-term goals and the goals of the Department.

95. TURF WARS BETWEEN PROGRAM OFFICES

Question: It's been a constant challenge for decades at the Department of Energy to get the basic and applied offices to work together. This is a serious problem and runs counter to the Department's core mission of developing scientific breakthroughs and ultimately turning those discoveries into applied solutions to energy problems.

Madame Undersecretary, I've heard that a long-running philosophy in the Office of Science to stay entirely away from applied or use-inspired work has been one factor that prevents this much-needed collaboration across basic and applied labs. Is this a serious problem, and what have you done in conjunction with the Undersecretary for Science to fix this problem?

I've also heard that a mentality of "protecting one's turf" in each program office historically stamped out any willingness to work with other program officers or to devote funding to joint efforts. How have you address this turf mentality?

Answer: The current working relationship among the three Under Secretaries is unprecedented. In particular, the Under Secretaries of Energy and Science meet weekly to coordinate activities and address common concerns. We are currently planning joint crosscutting activities where fundamental scientific understanding is an identified and necessary part of overcoming key technology barriers. We will be able to share more about these crosscutting activities as they mature. In addition, there is a history of Office of Science and technology program offices working together to identify basic research for addressing technology development roadblocks, as reflected in the "Basic Research Needs" series of reports available on line at http://www.science.doe.gov/bes/reports/list.html. At the staff level, program managers from the Office of Science and DOE technology program offices converse regularly—and have done so for many years—to learn from one another and coordinate their portfolios. For a number of years the basic and applied program offices have also conducted joint grantee/contractor meetings in common areas of research (e.g., solar, hydrogen, and biofuels) to facilitate communication and coordination among the researchers.

Similarly, the applied program offices are working together more closely than ever. The Under Secretary of Energy holds weekly "Cabinet" meetings to share information and best practices, address common concerns, and initiate collaborative efforts. The "turf mentality" is addressed by senior leadership working together, and directing their respective staffs to do the same.

QUESTIONS SUBMITTED BY REPRESENTATIVE RYAN

Question: Ms. Johnson and Ms. Zoi, I understand that the Department of Energy is doing a lot of work in the Vehicle Technologies Program, in particular on developing and demonstrating plug-in hybrid components such as batteries. The Department's work in this area has largely focused on lithium-ion technology. While this technology may have promise, it is not the only technology out there. For example, the University of Akron is working on a new polymer membrane technology to develop rechargeable nickel – zinc batteries as an alternative to lithium – ion. Unlike lithium, the zinc raw material is US sourced, is low cost, and is recyclable. They tell me that the technology can also lead to new zinc – air batteries and zinc air fuel cells.

Are you aware of this research? What is DOE doing to ensure that it is encouraging the development of alternate promising technologies such nickel-zinc batteries as well as wider known technologies such as the lithium-ion batteries?

Answer: The Office of Vehicle Technologies within the Department of Energy is aware of the nickel-zinc (Ni/Zn) battery technology, and the recent developments in industry, for example by PowerGenix.

DOE regularly solicits proposals for research and development through competitive Funding Opportunity Announcements (FOAs). The Department has prepared a new FOA expected to be released in the next several months, focused on higher energy and lower cost batteries. The responses will be competitively evaluated by subject area experts. DOE expects to fund proposals based on a detailed review of their merits for achieving electric drive battery performance targets. Non lithium-ion technologies are considered in all funding opportunities.

Ni/Zn batteries have not been pursued by major automotive manufacturers for electric drive vehicles because currently available Ni/Zn systems do not perform as well as lithium-ion. State of the art Ni/Zn cells for consumer products have approximately 50 percent of the energy of lithium-ion cells. The life of Ni/Zn cells is reported (by developers of the technology) to be approximately 500 cycles while commercial lithium-ion cells last 1,000-1,500 cycles. Ni/Zn is reported to cost approximately 40 cents per watt-hour, while commercial lithium-ion cells cost 25 cents per watt-hour. Although zinc is abundant and low cost, nickel can be expensive and its price has fluctuated widely in the last few years.

Although DOE is not involved with the research effort on a new polymer membrane technology for use on rechargeable Ni/Zn batteries at the University of Akron, this technology could benefit the performance and life of the Ni/Zn system. The Vehicle Technologies Program would encourage the University of Akron and others to apply for one of the upcoming competitive FOAs

The Department recognizes that the need for further improvement of a specific technology does not mean that it should be ignored. Therefore we constantly monitor developments in industry and the research community that might make a technology applicable to advanced vehicles.

QUESTIONS SUBMITTED BY REPRESENTATIVE CALVERT

1. RECOVERY ACT SPENDING – STATE ENERGY PROGRAM

Question: Just yesterday, the Los Angeles Times ran a story about the California Energy Commission's decision to award Recovery Act funding to an energy company that isn't even in California. At a time when California has an unemployment rate of 12.5%, it is safe to say this is not only appalling to me but to millions of Californians.

The Portland, Oregon company, who does not currently employ any workers in California, received nearly two-thirds of the $30 million that was awarded under the State Energy Program's Municipal and Commercial Building Retrofit Program

Assistant Secretary Zoi, your office oversees the State Energy Program, correct?

While I certainly believe most of the blame for such an offensive action like this lies with the State officials who made this decision, I also believe the federal office responsible for advancing the funding to the state provide adequate oversight once funds are released. In fact, the Obama Administration has made it clear that its oversight of the Recovery Act funds is something it takes seriously.

Therefore, can you tell me if the guidance or regulations you provided to states under the State Energy Program instructed them to only provide awards to entities that actually employed workers in their state?

Did you at least instruct them to give additional weight when scoring funding proposals to entities that actually employed workers in their state? If not, why?

Answer: The Weatherization and Intergovernmental Program in the Office of Energy Efficiency and Renewable Energy manages the State Energy Program.

The Department has not provided guidance to States that would limit or prohibit interstate commerce or partnerships between States nor was the Department provided such authority in the statute that establishes the State Energy Program.

The Department did not provide either guidance or requirements that would give additional weight to proposals that employed workers in a particular state. The Recovery Act goals for job creation are national in scope. The California program referenced is a job-training program that will include labor and offices in the State to conduct the work. The winning proposal is from a nationally recognized company in this field, and the program outcomes will clearly benefit the citizens of California.

2. RECOVERY ACT SPENDING – WEATHERIZATION ASSISTANCE PROGRAM

Question: Assistant Secretary Zoi, the unemployment rate in California is 12.5%. In some of the communities in my district the unemployment rate is closer to 20%. I point this out because we are holding this hearing more than a year after the Recovery Act was signed into law by President Obama and programs you are responsible for are still holding millions.

Just a few weeks ago, your Department's Inspector General released a report on your progress in implementing the Weatherization Assistance Program under the Recovery Act. The report found that as of February 2010 only a small percentage of Recovery Act weatherization funds had been spent and few homes had actually been weatherized. Only $368.2 million (less than 8 percent) of the total award of $4.73 billion had been drawn by grantees for weatherization work

Astonishingly, of the 43,400 units planned to be weatherized in California, only 12 units were completed as of December. As bad as that sounds, the situation in Texas is even worse, out of 33,908 planned units a grand total of ZERO units had been weatherized as of December.

The Inspector General stated in the report "we found this data alarming." I think it's safe to assume most of us up here on the dais share the Inspector General's sentiment.

Can you tell me as of today if the Recovery Act funds have weatherized more than 12 homes in California, and if so, how many?

To be fair, my friends on the other side of the aisle here in Congress did not make your job easy when they crafted the Recovery Act. The legislation required that recipients of weatherization funds pay workers in accordance with the Davis-Bacon Act, a requirement that was not previously applicable to the weatherization program. According to the Inspector General, the development of the Davis-Bacon guidance was not completed until October of last year delaying the weatherization of homes.

Is it safe to say the Davis-Bacon requirement inserted by the Democratic majority had a negative impact in terms of putting people to work weatherizing homes in a timely fashion?

The FY11 budget request includes an additional $385 million for the Weatherization Program, which represents a 43% increase over the FY10 program funding level.

Given our country's record level deficit spending, how can you ask this Subcommittee for a 43% increase for a program that is still sitting on billions of dollars of unspent money?

Answer: Through March 2010, Recovery Act funding for the Weatherization Assistance Program (WAP) is estimated to have weatherized 2,408 homes in the state of California. In detail, 12 units were reported complete through the end of December 2009; since then the State has steadily been on an upward production trajectory, with 305 units estimated to have been completed in January 2010, 704 units completed in February 2010, and 1,387 units estimated to have been completed in March 2010. As of May 20, 2010, the State has drawn down approximately $18.6 million or 10 percent of its award of $185.8 million

Also as of May 20, 2010, draw-downs by all states for WAP Recovery Act formula grants amounted to $909,485,558, or 18.5 percent of the total funds available for Recovery Act funded weatherization activities.

Davis-Bacon Act (DBA) Requirements. DOE continues to provide technical assistance to cities and counties to accelerate home weatherization with Recovery Act funded WAP grants that have been awarded to States (recipients) for weatherization work that is performed by local agencies (subrecipients) and their contractors. Historically, the WAP has not been subject to DBA prevailing wage requirements. However, the Recovery Act required that all workers employed by contractors and subcontractors on projects "funded directly by or assisted in whole or in part by" Recovery Act funds be paid prevailing wages as determined by the Secretary of Labor.

There are several reasons why WAP Recovery funded weatherization activities were not implemented as quickly as DOE would have liked. Recipients and subrecipients of WAP grants were encouraged to begin weatherization activities immediately. However, at the time of DOE's initial implementation of Recovery Act weatherization activities, the Department of Labor's (DOL) wage determinations (WD) that set forth prevailing wage rates for DBA-covered construction work did not cover many of these activities. This meant that Recovery Act funded contractors and subcontractors were going to have to determine from the WDs the appropriate worker classifications to use for weatherization activities, which meant that they would have to review and choose from many different worker classifications for the work a "weatherization worker" performs. Concerned that this effort would be too difficult for contractors unfamiliar with choosing worker classifications and that this would slow implementation of weatherization work, DOE requested that DOL provide special project WDs to make it easier for WAP recipients and subrecipients to comply with DBA prevailing wage requirements. DOL therefore created new Residential Weatherization WDs for each State and incorporated specific new worker classifications for Weatherization Workers: Doors & Windows Replacement Worker, and HVAC, Furnace, Heating & Cooling Repair, Installation, Replacement Worker. It took some time for DOL to issue the new Residential Weatherization WDs and for DOE to incorporate the new WDs into grants, and some recipients and subrecipients were reluctant to begin weatherization activities until these WDs were in place. In addition, some States such as California had prevailing wage rates that needed to be reconciled with the new Residential Weatherization wage rates. Also, some recipients and subrecipients were reluctant to undertake weatherization activities due to DBA compliance requirements such as the need to complete and file weekly certified payrolls. DOE has worked hard to make information available to recipients and subrecipients regarding DBA compliance requirements through webinars with DOL officials and other experts, answering questions from State Energy Offices and subrecipient in other forums, and posting numerous Frequently Asked Questions and Answers on the WAP website at: http://www1.eere.energy.gov/eere_faq/default.aspx?pid=10&spid=1.

FY 2011 WAP Budget Request. The Department's FY11 budget request includes $300 million (non-Recovery Act funds) for the WAP, which represents a 43% increase over the FY10 program funding level. Recipients of these funds will not be subject to DBA requirements.WAP contributes to DOE's goals of reducing energy demand and creating a green workforce.

Since 1976, the program has helped 6.25 million American families, resulting in an estimated average energy savings of $400 per year for an individual family for 2009 and increasing the comfort and safety of their homes. The program also provides specialized training and career development opportunities to thousands of workers in the residential home energy audit and retrofit field.

Detailed Justification

Weatherization Assistance

(dollars in thousands)		
FY 2009	**FY 2010**	**FY 2011**
436,770	**176,700**	**262,500**

WAP is one of the largest sources of funds for technically advanced residential energy retrofit providers. Funds are allocated on a formula basis and awarded to States, U.S. Territories, the District of Columbia, and Native American tribal governments to increase the energy efficiency of homes occupied by low-income families. These agencies, in turn, contract with 982 local governmental or nonprofit agencies to deliver weatherization services to low-income clients in their areas.

Weatherization service providers choose the best package of efficiency measures for each home based on a comprehensive computerized energy audit performed by highly trained auditing staff employed by the subgrantees. Typical energy conservation measures include: installing insulation; sealing ducts; tuning and repairing heating and cooling systems; mitigating air infiltration; and reducing electric base load consumption. The consistent delivery of quality services is addressed through active State training and technical support programs. Grant funded training allows for the introduction advanced assessment and installation techniques and continuing professional development for workers.

The FY 2011 target is to weatherize 33,484 low-income homes. The majority of WAP funding is allocated to the States as operating funds for this purpose, i.e., for labor, materials, equipment and administrative systems. The Recovery Act increased the percentage (approximately twice as much as previous years) of the total program funding allocated for State-based training and technical assistance to maintain a high standard of technology application, effectiveness and results. Most training and technical assistance is performed at State and local levels.

Training and Technical Assistance

(dollars in thousands)		
FY 2009	FY 2010	FY 2011
13,230	3,300	7,500

DOE directed weatherization training and technical assistance activities improve the effectiveness and efficiency of WAP. These resources support strategic planning and analysis; program performance measurement and documentation; and facilitation of (e.g., through pilot programs, publications, training programs, workshops and peer exchange) advanced techniques and collaborative strategies. An ongoing national evaluation is verifying the overall energy savings and cost-effectiveness of the program and determining where enhancements can be made to improve the outcomes for energy efficiency and health and safety

Innovation in Weatherization

(dollars in thousands)		
FY 2009	FY 2010	FY 2011
0	30,000	30,000

The objectives of WAP's Innovation in Weatherization Program are to demonstrate new ways to increase the number of low-income homes weatherized and lower the Federal per home cost for residential energy retrofits, while also establishing a stable funding base. DOE will form partnerships with non-traditional weatherization providers such as foundations and other non-profits, labor unions, churches, private contractors, large companies, and other groups. These organizations will provide leadership in leveraging financial resources and managing the home energy retrofit process. Innovation in Weatherization contributes directly to priorities for the expansion of a green workforce and the energy retrofit of one million homes per year. A key component will be the ability of grantees to obtain $3 in non-Federal contributions for every $1 investment from DOE. This program will build upon lessons learned from the Weatherization Innovation pilot program funded in FY 2010.

In FY 2011 the WAP also intends to fund various other pilot projects that will demonstrate best practices and new innovations emanating from organizations outside the traditional low-income weatherization network. DOE will evaluate the results and processes undertaken in these pilot projects in order to identify specific areas where the core WAP can be enhanced by alternative funding sources or varying approaches to accomplishing its core mission of energy efficiency and health and safety for low-income Americans.

Total, Weatherization Assistance Grants

(dollars in thousands)		
FY 2009	**FY 2010**	**FY 2011**
450,000	**210,000**	**300,000**

Explanation of Funding Changes

	FY 2011 vs. FY 2010 ($000)
Weatherization Assistance	
Additional funding will support the President's goal to increase the number of low-income homes weatherized.	+85,800
Technical and Training Assistance	
The increase will support the completion of the national program evaluation.	+4,200
Total, Weatherization Assistance Program	**+90,000**

3. FOSSIL FUEL RESEARCH

Question: Research and development into air quality issues created by oil and gas exploration and production has withered to almost nothing. Many years ago there was a robust program that funded key work in this area at the national laboratories in close collaboration with industry. Considering this and the fact that the Environmental Protection Agency is promulgating stricter ozone standards, shouldn't the Department develop a more concerted and better funded program in this area?

Answer: A large number of air quality related projects were funded in the past through the oil and gas program, including a few ongoing projects. These include Reciprocating Engine Emissions Control and Monitoring at Kansas State University, as well as the NETL in-house research efforts on estimation of the impact of oil and gas exploration and production activities on regional air quality. We are not requesting additional funding for air quality research, in general or specifically in ozone, as this area is more appropriate for the private sector.

4. BUILDING ENERGY EFFICIENCY E-RIC

Question: Recently the Department of Energy, along with the Department of Commerce, the Small Business Administration and other federal offices issued a request for proposals for the establishment of an Energy Research Innovation Cluster, or E-RIC. The idea is certainly laudable and I am sure that there will be many great proposals – including one led by Lawrence Berkeley National Laboratory.

Why establish a national research center that is limited to exclusively focusing on one "regional cluster?"

If there is just one of these centers, shouldn't its focus be much broader than one region? If not, will the Department look favorably on proposals that include the ability to disseminate technology to other regions through research partnerships - will this be a key factor in the proposal review process?

Answer: The E-RIC concept is focused on developing networks of building-technology stakeholders in order to nurture and deliver solutions for energy-efficient buildings systems. Thus, the structure of the Hub and the encompasing E-RIC is designed to minimize or eliminate the barriers that normally exist between early-stage research, applied research, commercialization, and deployment of new technologies. Working at the regional scale allows the E-RIC to reach a critical mass and unlock accelerated technology development and deployment in building systems. While the E-RIC will have a primarily regional focus, DOE explicitly allows the formation of strategic partnerships with entities outside the geographic region. The results from this accelerated technology pipeline will ultimately have national and international benefits.

In accordance with standard DOE policy, the review process will be based on the merit review criteria articulated in the funding announcement, which include factors related to the applicant's plan to disseminate research results to industry.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: The Energy Policy Act of 2005 authorized the hydroelectric production incentive program. I understand that money has never been requested nor appropriated for this program. Are you familiar with this program or could you explain why no funding has been requested for this program in the past? I understand that part of the reason why no funding has been provided may be that there has not been a program that would qualify since it was authorized. If a project was submitted for funding that qualified, would you consider it for funding?

Answer: The Department of Energy is familiar with the Hydroelectric Production Incentive program authorized by the Energy Policy Act of 2005. Should Congress appropriate funding for this program, the Department would evaluate applications from projects to determine their eligibility for payments, in accordance with the requirements set forth in the Act.

While funds have not been appropriated for the Hydroelectric Production Incentive, the Energy Policy Act of 2005 did extend the Renewable Electricity Production Tax Credit to include electricity generated by qualified hydropower projects. While not equal in value to the Hydroelectric Production Incentive, the Renewable Electricity Production Tax Credit does provide an incentive for investment in efficiency improvements and additions to hydroelectric production capacity by tax-paying entities.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: I have a project in my district called the Chester Diversion Hydroelectric Power Project that appears to be qualified. Would you be willing to work with me to review this project and see if it would be eligible for funding under the guidelines of the grant program?

Answer:The Department of Energy would certainly review the project in question to determine its eligibility for funding under the Hydropower Production Incentive program authorized by the Energy Policy Act of 2005. Project representatives can contact Alejandro Moreno, Water Program Team Leader, to discuss such a review.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Under-Secretary Johnson, I understand the applied energy laboratories are working with you to write technology development roadmaps to get new technologies into the private sector. Can you tell me the status of that effort?

Answer: The DOE applied programs have extensive activities underway with industry, universities, and National Laboratories to both develop technology research and development roadmaps, as well as strengthen mechanisms to rapidly accelerate the commercialization of these technologies. Technology roadmapping is conducted and frequently updated for most of the applied technology programs to ensure that the most important research is pursued. Numerous examples of such roadmaps are available at: http://www1.eere.energy.gov/pir/table.html under "Plans". It is useful to also review the MultiYear Research Plans listed there.

The DOE applied programs also conduct extensive work to move technologies quickly into commercial markets. Much of the research done by the applied energy programs is through cost-shared competitive solicitations with industry. This ensures that taxpayer dollars are well-leveraged against private capital, and also ensures that companies with a strong motivation to quickly move the new technologies into the market are involved. Research supported at the National Laboratories and universities is usually at an earlier stage of development and is not ready to be commercialized, but is often linked with industry through technical teaming, cooperative research and development agreements, and a wide variety of other mechanisms to ensure that it can be quickly commercialized.

My office has also been working with the applied-energy offices (EERE, FE, NE, OE) and the associated National Laboratories (NREL, NETL, INL) to identify the new energy technologies that could help achieve the Administration's stated greenhouse gas reduction goals for 2020 and 2050. We hold formal, quarterly meetings with all the program senior management and applied lab directors, as well as numerous technical meetings throughout the year to actively engage our Labs in program planning.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Director Hoffman, cyber security remains a high priority for our all facets of government operations and our nation's electric grid. As you probably know, the INL has a very unique capability in the area of testing and evaluation of the reliability and security of our nation's electrical grid infrastructure. Could you tell me what specific actions and programs within DOE address this national concern? Could you tell me how DOE plans to utilize the unique capabilities of the INL?

Answer: The Office of Electricity Delivery and Energy Reliability's Cybersecurity for Energy Delivery Systems (CEDS) program fosters partnerships between the government, national laboratories, vendors, system integrators, academia, and asset owners to perform next-generation R&D, vulnerability assessments and mitigation, integrated risk analysis, and industry outreach. In addition to the research capabilities and resources of the Argonne, Idaho, Los Alamos, Oak Ridge, Pacific Northwest, and Sandia National Laboratories (which make up the Departments National SCADA Test Bed), the CEDS program features cost-shared R&D with academia and industry leaders.

To accelerate the development of next-generation control systems, DOE supports industry-led, cost-shared projects that work closely with National SCADA Test Bed (NSTB) labs and other private-sector partners to develop and commercialize tools and technologies that can make real and immediate impacts on energy sector cyber security. DOE also funds the Trustworthy Cyber Infrastructure for the Power Grid (TCIPG) research program, a consortium of four universities that will develop and integrate information technologies with such properties as real-time availability, integrity, authentication, and confidentiality that are key to a modern, reliable, and efficient electric power grid.

DOE efforts to enhance the cyber security of the energy infrastructure have produced significant results. DOE has developed more secure communications methods between energy control systems and field devices, developed tools and methods to help utilities assess their security posture, and provided extensive cyber security training to more than 1,800 energy owners and operators to help them prevent, detect, and mitigate cyber penetration.

Idaho National Laboratory's (INL) unique vulnerability assessment resources and capabilities contribute to the research and testing capabilities of the National SCADA Test Bed (NSTB) and are a key part of the CEDS R&D Program. Launched in 2003, the NSTB is a state-of-the-art national resource designed to aid government and industry in securing control systems against cyber attack through vulnerability assessments, mitigation research, security training, and focused R&D efforts. While INL leads the majority of NSTB assessments, the Department has expanded the NSTB to include resources and capabilities from six national laboratories.

To date, NSTB researchers have assessed the majority of SCADA/energy management systems being offered in the energy sector. Thirty-five test bed and on-site field assessments of common control systems and components have led vendors to develop 12 hardened control system designs. Today, more than 45 of these hardened SCADA/EMS systems have been deployed to better protect the power grid from cyber attacks, and vendors have also issued many software patches to better secure legacy systems, which are now being used by 82 system applications in the sector. Findings from NSTB vulnerability assessments have also been generalized by INL into its Common Vulnerabilities Report, which includes mitigation strategies asset owners across the sector can use to better secure their systems. Test bed assessments of two additional vendor systems are included in the FY 2011 budget.

Through INL, NSTB has trained more than 1,900 stakeholders in its introductory, intermediate, and advanced SCADA Security courses. INL has trained more than 80 energy sector asset owner personnel in its Advanced Red Team/Blue Team SCADA Security Training, an intensive week-long course designed to leave participants with security techniques that they can immediately use in their facilities. The FY 2011 request continues support for this critical training.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Director Hoffman, with large grants being awarded to deploy Smart Grid technologies, what role is your office playing in the testing and evaluation of Smart Grid reliability and security?

Answer: OE has a leading role in the testing and evaluation of smart grid components for reliability and security.

Each of the Smart Grid Grant projects funded by the Recovery Act awarded by OE is required to demonstrate a cyber security focus, including a cyber security implementation plan that will be subject to an annual review. Evaluating smart grid reliability is an ongoing part of the Smart Grid Investment Grants. Reporting requirements include impact metrics that seek to establish a baseline of reliability characteristics and find common usage within the electric power industry. These metrics characterize, among other things, the average annual number and duration of customer power outages.

OE is also supporting the Advanced Security Acceleration Project – Smart Grid (ASAP-SG) that was created by the Smart Grid Security Working Group of the UCA International Users Group to develop smart grid security guidelines. The ASAP-SG is a public-private collaboration working to develop requirements for use by utilities that purchase smart grid components, vendors who develop these components, and government entities responsible for securing critical infrastructure against cyber attack.

ASAP-SG has produced several security profile documents that provide actionable guidance to utilities, vendors, and government entities on how to build cyber security into smart grid components in the development stage and how to implement these safeguards when the smart grid components are integrated with the power grid. The guidelines are vendor-neutral and are applicable to any advanced metering infrastructure (AMI) smart grid architecture from the data management system up to and including the home area network smart meter interface. Two security profiles have been completed - one that offers guidelines for securing AMI and another that offers guidelines for securing third-party data access. A third security profile that offers guidelines for securing distribution automation systems is currently in progress.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Has DOE provided a forum for "end users" of the NGNP to step forward and describe how they would be willing to participate in funding the NGNP from a developmental R&D program? If so, could you please identify what companies in what industries have expressed a willingness to cost share on this important program?

Answer: The Office of Nuclear Energy has twice submitted Requests for Information and Expressions of Interest to industry for participation in the NGNP program. The first was in May 2004 and the second in April 2008. Industry responses to these requests have helped to shape the Department's implementation of NGNP, including the offer of financial assistance made by the Department in FY 2009 for the conceptual design of the NGNP. Additionally, the Idaho National Laboratory has helped to organize industry interest in NGNP, resulting in the formation of an industry alliance. Corporate members of this alliance include: AREVA NP, Babcok & Wilcox, Chevron, ConocoPhillips, the Dow Chemical Company, Entergy Nuclear Operations, General Atomics, Pebble Bed Modular Reactor (Pty) Ltd., PotashCorp, Shaw, and Westinghouse Electric Company.

If the Secretary elects to proceed to the next phase of the NGNP project, a new cost- sharing offer for preliminary design, licensing, final design, and construction would be issued.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Congress has appropriated many millions of dollars to support the NGNP program. I am pleased to see that DOE has announced it will award $40 million for design work on the Next Generation Nuclear Plant. The question DOE must address is whether industry or the government will assume the bulk of the program funding for the first 5 years. Currently OMB thinks industry should lead the funding for the front end of NGNP and industry thinks the government should lead the funding for the first 5 years. Neither side appears to be changing its position. I noticed that the funding announcement states that "final cost-shared awards are subject to the negotiation of acceptable terms and conditions." How is DOE working to resolve this impasse? As a strong advocate of funding, I am greatly concerned that if this impasse remains, we will have wasted millions of dollars in funding for this program. Could you please elaborate on what you are doing to resolve this issue?

Answer: DOE expects that industry will share costs with the Department in accordance with the appropriate provisions of the Energy Policy Act (EPAct) of 2005.

DOE is presently negotiating with the industry awardees for NGNP conceptual design, including consideration of alternative cost-sharing provisions as allowed under EPAct 2005. As the program moves forward, it is essential that all participants and stakeholders understand the cost expectations. While it is premature to speculate on negotiations for the next phase of the project, future agreements will include clear cost-sharing requirements.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: When I meet with industry representatives, I hear that in order to put together a real public-private partnership to build NGNP, we will need to make changes to the Energy Policy Act of 2005 on issues like where the first plant will be built and cost-sharing. For example, industry representatives tell me a 50-50 cost-share during the design phase of the project cannot be sold to a board of directors but industry would be willing to shoulder more of the cost during construction once a license is awarded by the NRC. Can you give me your perspective on how we should proceed with NGNP and, for the record, can DOE give the subcommittee any recommended changes to EPAct needed to facilitate development of a public-private partnership to deploy NGNP?

Answer: Under Secretary Johnson: DOE is implementing the NGNP Project in full compliance with the EPAct authorization, as described in the April 2010 *NGNP Report to Congress*.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: Assistant Secretary Markowsky, the FY2010 energy and water appropriations bill provided $20 million for unconventional fuel development. Can you tell me what you plan to do with that money?

Answer: As directed in the appropriation bill, a research and development strategy for unconventional oil, gas and coal resources is being developed and a report is being prepared. The funds will be used for some new and appropriate on-going unconventional oil, gas, and coal resources projects identified in the strategy. A funding opportunity announcement seeking proposals for new projects will be issued soon.

QUESTIONS SUBMITTED BY REPRESENTATIVE SIMPSON

Question: DOE recently announced a new policy concerning the DOE contractor pension costs that will lower the required funding level for contractor pension plans, which DOE expects will significantly cut the anticipated pension liability for this year. For example, the budget says that the projected pension liability for Environmental Management will drop from $567 million to $153 million. Could you please discuss the new pension policy?

Answer: In January, the Department decided that, due to the rising costs for the reimbursement of DOE Management and Operating (M&O) and major site management contractor employee defined benefit pension plan (DB) contributions, steps could be taken to improve and strengthen the Department's oversight of the contractor's costs in this area, although that is an area of indirect costs we expect the contractors to manage according to their Disclosure Statement, as required by Cost Accounting Standards, without our input.

To this end, the Department directed that a number of additional steps be taken to address the unpredictability and level of DOE reimbursements to contractor DB pension plans, and to strengthen the Department's oversight of contractor DB pension plan management. Specifically, the Department eliminated the DOE requirement that every contractor's DB pension plan for its employees be funded at the 80 percent level. .The new policy requires the Department to reimburse contractors for the amounts required to fund their DB pension plans at a level equivalent to the minimum amount required by the Employment Retirement Income Security Act (ERISA) as amended by the Pension Protection Act (PPA), or higher if necessary for a contractor DB pension plan to have a funded status of at least 60 percent. DOE is working to harmonize the contractor's IRS and PPA requirements with DOE and the contractor's requirement to follow and implement Cost Accounting Standards on covered federal contracts.

Question: Do you think that this will cut costs in the short-term but that it could ultimately result in increased costs over the long-term?

Answer: Overall, the new policy requires the Department to reimburse contractors for their DB pension plans so the plans are funded at least to the 60% level. Under the Pension Protection Act, the plans are required to meet the 100% funding target in 2011. The Department's new funding policy continues to reimburse the contractors for these legally required contributions to ensure that the plans will be funded to a level that avoids financial penalties and severe limitations on benefits. Based on the information submitted by the contractors' actuaries, we do not expect that this new policy will result in increased costs over the long-term, which assumes that projected earnings and other estimates will met by the corresponding actuals, as a minimum. If the projected earnings and other estimates are not in fact met, there will be increased costs in the future.

Question: Also, will all sites be required to abide by the new policy or will sites be permitted to set their own required funding level? For example, I know that there have been discussions at some offices to set the required funding level higher than the minimum 60%. Would DOE be willing to take a look at sites on an individual basis or is this going to be a complex-wide policy?

Answer: Although that is an area of indirect costs we expect the contractors to manage according to their Disclosure Statement, as required by Cost Accounting Standards, without our input, exceptions to the new policy will be reviewed on a case-by-case basis. The Department has maintained and will continue to maintain a dialogue with the site contractors and program offices to review contractor requests for funding in excess of the minimum required contribution.

THURSDAY, MARCH 18, 2010.

DEPARTMENT OF ENERGY—SCIENCE, ARPA–E 2011 BUDGET

WITNESSES

STEVEN KOONIN, UNDER SECRETARY FOR SCIENCE, UNITED STATES DEPARTMENT OF ENERGY

WILLIAM BRINKMAN, DIRECTOR, OFFICE OF SCIENCE, UNITED STATES DEPARTMENT OF ENERGY

ARUN MAJUMDAR, DIRECTOR, ADVANCED RESEARCH PROJECTS AGENCY-ENERGY, (ARPA–E) UNITED STATES DEPARTMENT OF ENERGY

Mr. PASTOR. Hearing will be in order. Good morning, today we are going to hear from the Office of Science and ARPA–E within the Department of Energy. We have before us today Dr. Steven Koonin, Under Secretary for Science; Dr. William Brinkman, good morning, Director of the Office of Science and Dr. Arun Majumdar, Director of ARPA–E.

The budget request for science is $5.1 billion, a 4.4 percent increase from the present appropriation of $4.9 billion. While America's science arguably continues to be the best in the world, our margin of leadership is neither as wide nor as clear-cut as it has been in the past. The Secretary of Energy, Dr. Chu, has said he regards his two principal challenges to be energy independence and climate change. In the long term, the answer to both these questions starts with the Office of Science.

While this committee has been supportive of the Office of Science and ARPA–E, we continue to have concerns regarding the redundancy and interaction of several recent organizational initiatives, the energy innovation hubs, ARPA–E and the Energy Frontier Research Centers. While ARPA–E has received early and positive reviews, the justification in part was that these models were necessary because of the administration's perception that the Department's existing programs were not sufficiently effective agents of transformational or disruptive technological advances. We therefore turn our attention not only to ARPA–E's performance, but to tuning the performance of the existing science programs and labs.

We also support strengthening America's leadership in science and advancing energy innovations. However in doing so we must ensure that we eliminate redundancy in order to maximize the scientific and technological advances within these tight fiscal constraints. We are interested particularly in the timing of each of the major group programs to ensure that we are proceeding in deliberate and thoughtful manners.

The three of you, I ask you to ensure that the hearing record, questions for the record and any supporting information requested by the subcommittee are delivered in final form to the subcommittee no later than 4 weeks from the time you receive them. Members who have additional questions for the record, we will have until the close of business tomorrow and please provide them to the subcommittee office.

Your testimony is in the record.

With those opening comments, I would like to yield to my ranking member.

Mr. FRELINGHUYSEN. Good morning, gentlemen, thank you for being with us. I guess this is your first appearance before our committee, and I join the chairman in welcoming you here.

The administration's budget request for sciences is $5.1 billion, a 4.4 increase over last year. For ARPA–E, the administration is including its first request for regular appropriations. To date, this program has only been funded through the Stimulus Act. Mr. Majumdar, I hope you will be able to tell us today what successes you have had and why we should consider this program for scarce appropriated dollars.

Gentlemen, I made it repeatedly clear that I and my constituents are alarmed by the growing deficit and the ongoing economic problems. I don't feel that simply expanding the government bureaucracy is going to spend us out of our situation, and your programs received nearly $2 billion in Stimulus Act funds.

It looks as if this may be our only opportunity this year to consider the expenditure of Stimulus Act funds in an open forum. I hope you will be able to explain to us why your programs were of good use, of those funds given by Congress and how they indeed stimulated job creation.

Mr. Brinkman, I think you know, while I haven't made acquaintance with you, I understand you are a former New Jersey resident, so I suspect that at some time I may have represented you. I have been a strong supporter of basic science programs. And in my backyard, not immediate backyard, is the Princeton Plasma Physics Laboratory, and they do some remarkable work there and that is matched by other DOE labs around the country. So I look forward to forging a good strong relationship with you in particular.

However, the administration has put us into a bind again this year by cutting its request for critical water programs. That is the other part of this committee's agenda, the Army Corps budget. I have been hearing all week from my constituents, who have been hard hit by the recent flooding. So to put a more human face on it, we have sort of a battle for pretty precious resources here and some natural disasters, of course, can change that equation overnight.

One of the greatest challenges your program had and will likely continue to have is to clearly articulate to us and to the American people why it is important that we spend billions of dollars on your programs. I think we who serve on this committee, we know that, but I think sometimes the general population is unaware of what you do, and I think part of the job, our job and your job is to sort of explain what we are doing, why these investments are important and ala the front page of The New York Times today, why in a very competitive world environment we need to match, at least match, what our foreign competitors are doing.

You will need to show us why we should pay for basic research that will often not show results for decades when that money could be easily used to help protect our communities against flooding and other disasters or dredge our harbors or repair our roads. I am not saying this as a criticism, but as a reminder that budget pressures are very strong and we will need to find ways to communicate with those who may not understand all of what you do.

As a committee, we are also looking forward to learning more about our, I guess, the DOE's equivalent of DARPA, ARPA–E and we look forward to hearing your testimony.

Obviously, the administration's request is a strong vote of confidence in your program. I hope you will be able to show us how it is warranted.

Again, Mr. Chairman, thank you very much for the time, and we welcome our guests.

Mr. PASTOR. Mr. Under Secretary.

Mr. KOONIN. Mr. Chairman, Mr. Frelinghuysen and members of the committee, thank you for asking me to provide an overview of the President's fiscal 2011 budget request for the Department of Energy's Office of Science. The DOE today is called upon to help address many of the greatest challenges facing our Nation, transitioning to an efficient, clean and reliable energy system, ensuring nuclear security even as we reduce our stockpile and enhancing economic competitiveness in an increasingly complicated world.

Let me assure you that the Department's formidable assets are being focused on these goals, and I will give you a good example in a moment. But as we work on these pressing societal problems, it is also important to sustain the Department's discovery activities and the wonder that they engender. Even with all we know about the world, there are so many unanswered questions.

What of the dark matter in energy that make up 95 percent of the universe? How do complex molecules work together to make life, and what amazing materials remain to be discovered or designed? Questions like these inspire our young people to become tomorrow's scientists and engineers, and the technologies developed to answer such questions, as well as the answers themselves, better equip us to deal with worldly challenges. Such spin-offs from discovery research have happened regularly for centuries, and there is every reason to expect that they will continue, if not accelerate, in the future.

Before I turn to budget specifics, I would like to spend a moment on my role in the Department. I am the first full-time Under Secretary for Science, a position with two aspects. The broader one is to act as a Department-wide chief research officer, identifying synergies and gaps in our research programs, looking after the health of our national laboratory activities, and ensuring that sound science and technology underpin everything the Department does.

The more focused aspect of my role is to take the directory port of Dr. Brinkman and backstop him in managing the Office of Science, setting its strategic directions, helping resolve some of the more difficult operational problems and ensuring its connectivity within and outside the Department.

Director Brinkman and I, with Secretary Chu's support and encouragement, are bringing Office of Science activities to bear more effectively on societal challenges, enhancing the impact and the relevance of our science even as we preserve our discovery base.

Much, but not all of our work must be inspired, if not informed, by opportunities for application. And conversely, DOE's energy technology programs must better capitalize on what science can offer.

We are therefore working together with Under Secretary Johnson to better couple programs and basic energy sciences, biological and environmental research and advanced scientific computing research with technology efforts, for workshops and joint programs.

Among the broader community, we are bringing together new and traditionally disjointed players through mechanisms like the Energy Research Frontier Centers, the hubs and ARPA–E.

DOE's NNSA also is a part of this effort. Working with Administrator D'Agostino, we are bringing the best of open science, content and practices, to nuclear security matters and conversely bringing some exciting NNSA capabilities to the open programs.

A variety of new or newly emphasized activities across the Department realized this strategy of unification and focus. I would like to highlight some of the more applied efforts contained within the Office of Science budget request. Dr. Brinkman's remarks will describe some of our office discovery activities.

The first of these is energy system simulation. Fifteen years of work in NNSA stockpile stewardship program has created an unprecedented and unique capability to integrate high performance computing, laboratory experiments and integral test data to better understand the nuclear stockpile.

At the same time, the Office of Science's ASCR program has advanced scientific hardware and software for more than a decade, and it is now time to apply these methods and experience to understand and optimize energy systems, improving designs and compressing the design cycle.

Creating such applications in partnership with industry and bringing them to commercial relevance can differentiate American manufacturing capabilities and enhance competitiveness while greatly improving energy technologies.

Our $20 million proposed internal combustion engine initiative in basic energy sciences builds upon basic combustion research and simulation experience as a first instance of such a program.

Needless to say, there are a number of other energy system applications amenable to this approach, including the electrical grid, carbon capture and sequestration and fission reactors.

A second area to highlight is inertial fusion energy. With the National Ignition Facility now operating well and ignition possible, if not likely, within the next 2 years, it is now timely to plan a serious push toward an inertial fusion energy demonstration within the next 15 to 20 years. Post-ignition experiments on the NIF will be needed to inform a coordinated R&D effort in which high reprate candidate drivers are developed, targets design optimized for gain and ease of fabrication and the balance of the system defined.

The $31 million request for high energy density laboratory plasmas in the Office of Fusion Energy Science budget request lays the groundwork for such a program. Inertial fusion energy could be truly one of the transformative energy technologies in the Department's portfolio.

A third area of interest is materials in extreme environments. Understanding and improving the behavior of materials in radiation environments is critically important to extending the life of the current fleet of fission reactors, developing new reactor fuels and designing fusion or fission facilities. It is also important to nuclear security applications.

The growing capabilities to synthesize, characterize and simulate materials in radiation environments can, therefore, fruitfully be applied across the Department. Indeed, some of the new Energy Frontier Research Centers we would like to establish or have are their focus.

Finally, I note that the Department is proposing to continue its efforts advancing the state of the art of high performance computing. The energy simulations I have mentioned, as well as an enormous body of other applied and basic work, build upon almost two decades of DOE leadership in creating high performance computing capabilities.

Our proposed budget for ASCR enhances support for hardware operating system and algorithm development and also promotes greater competitive access to our capabilities and capacity computing facilities.

With that, I thank you for your attention and would be pleased to answer any questions you might have.

Mr. PASTOR. Thank you very much.

[The information follows:]

Statement of Dr. Steven E. Koonin
Under Secretary for Science
U.S. Department of Energy
Before the
Subcommittee on Energy and Water Development
Committee on Appropriations
U.S. House of Representatives

FY 2011 Appropriations Hearing
March 18, 2010

Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee, thank you for the opportunity to appear here today to provide an overview of the President's Fiscal Year 2011 budget request for the Department of Energy's Office of Science. First, I would like to describe a few of the highest priority crosscutting initiatives for research in the Department and explain how funding mechanisms like the Energy Frontier Research Centers, the Energy Innovation Hubs, and ARPA-E complement our existing funding mechanisms. I'll close with a brief description of the request for the Office of Science and report on how we've used the $1.6 billion provided to Science through the American Recovery and Reinvestment Act.

FY 2011 BUDGET SUPPORTS STRATEGIC PRIORITIES

The FY 2011 budget request supports the Department's strategic priorities, which include transitioning to a low-carbon economy by developing and deploying clean and efficient energy technologies and investing in scientific discovery and innovation. We will enhance national security by ensuring the safety, security and effectiveness of the nuclear stockpile without testing and work with our international partners to secure vulnerable nuclear material around the world within four years. Making progress in cleanup of our nuclear legacy remains an important responsibility.

As the Department's chief research officer, it is my job to see that sound science and technology underpin every initiative the Department undertakes. In FY 2011 the Department will increasingly emphasize cross-cutting initiatives that link science throughout the Department, specifically with energy and national security programs. I believe that the Department will deliver solutions more quickly and efficiently if we can breach the traditional stovepipes, encourage the cross-fertilization of tools and techniques, and operate in a more integrated and coordinated manner.

One example where I believe the Department's multiple capabilities can be brought together is in the application of advanced simulation capabilities, where the skills we have developed are best in the world. To maintain our confidence in our weapons stockpile in a world without testing, the National Nuclear Security Administration has learned, over the past 15 years, how to combine modeling with laboratory experiments and historical test data to achieve unprecedented understanding and predictive capability for complex systems. In parallel, the Office of Science has pioneered the development of open community simulation codes through its SciDAC program. Both of these efforts can now be adapted to the broader needs in the Department. In particular, the time is ripe for leveraging those achievements to optimize energy technologies.

Combustion simulation: Our combustion simulation exemplifies our efforts to bring fundamental science to an energy application where simulation will likely create a competitive advantage for U.S. industry, reduce our dependence on oil, and produce jobs. Within Basic Energy Sciences, the President is requesting $20 million for combustion simulation. These funds will allow us to tie together existing, but disaggregated, work into a well-structured program to develop predictive tools, based upon sound fundamental scientific understanding, that can enable more rapid exploration of engine designs with greater accuracy. By focusing on development of the simulation capability, rather than on specific engine designs, this translational scientific and engineering research holds the promise of reducing product development times, increasing competitiveness, and helping us reach our energy independence goals more rapidly.

Scientific Computing: The budget proposes an increase of $36 million for the Office of Science's Leadership Computing Facilities and National Energy Research Scientific Computing Center. This suite of some of the fastest supercomputers in the world is available to more than 4,000 researchers largely on a competitive basis at a time when scientific computing is playing a more significant role in scientific discovery and policy-relevant climate modeling. The skills U.S. researchers develop on our existing machines will enable them to push to the next generation of extreme scale computing. This is not the usual case of raising an alarm about the United States being behind. Scientific simulation is an area where the Nation holds a current competitive advantage, and we see the potential to bring these competencies to bear in transforming fundamental engineering research for energy applications.

Climate Modeling: Climate modeling is central to one of the most significant economic policy questions of the coming decades, namely optimally reducing greenhouse gas emissions. While general physical principles and the current generation of models are more than sufficient to prompt concern over rising greenhouse gas levels, we must work to reduce model uncertainties and refine scientific understanding. The Department is asking to step up its effort by applying what it has learned in designing and implementing the best-in-the-world modeling and simulation methods developed through NNSA's stockpile stewardship program to equally complex problem of modeling climate response. The proposed increase of $15.8 million will bring the Office of Science's climate and earth system modeling effort to $85.6 million. It is crucial that the quality of our climate models be commensurate with their policy importance.

Other priorities

Radiation Resistant Materials: Better understanding of the behavior of materials in radiation environments is critically important for extending the life of the current fleet of fission reactors, development of new reactor fuels, and the investigation of next generation fission and fusion energy concepts. This will require new types of experiments and advanced simulations to probe how radiation-induced defects are formed and evolve and to develop approaches to mitigate their effect. Ultimately this could lead to the design of materials with enhanced resistance to radiation damage that could significantly lengthen the lifetime of nuclear reactors. This research will draw upon relevant expertise across the Department and is supported by increases in both Basic Energy Sciences and Fusion Energy Sciences.

A Technically Trained Workforce: RE-ENERGYSE, or Regaining our Energy and Scientific Edge, is a $55 million cross-cutting energy education effort incorporating $50 million in the Office of Energy Efficiency & Renewable Energy and $5 million in the Office of Nuclear Energy. RE-ENERGYSE activities are carried out in close coordination with the Office of Science, the National Science Foundation, and other agencies. This initiative is aimed at filling the gaps in the energy workforce pipeline by training current and future generations of energy professionals through fellowships for higher education, energy-focused curriculum development for technical training, and K-12 education and outreach with an exclusive focus on engineering and applied sciences. In this way RE-ENERGYSE programs are complementary to, yet separate and distinct from, existing $35.6 million Office of Science workforce development programs that are focused on basic science. The Science graduate student, postdoc, and early career awardees are overwhelmingly natural scientists, not engineers.

To ensure strong collaboration between the two offices, and to draw upon the Department's existing and successful resources, the Offices of Science and Energy Efficiency are creating one process of administration for grants and fellowships and a unified set of metrics for tracking and evaluation.

High Energy Density Science: The emerging field of high energy density science is also a growing area of focus for the Department. High energy density science is the study of matter at extreme conditions of temperature and pressure such as found in stars, at the cores of the giant planets, and in plasmas relevant to fusion energy. Experimental facilities and computational tools have become increasingly capable of investigating these exotic conditions and DOE plays a key role. From the study of materials under extreme conditions at the Linac Coherent Light Source at SLAC to the potential for demonstration of fusion ignition at the National Ignition Facility at Livermore we are pushing the scientific frontiers in this exciting field. The proposed increase of $6.5 million in High Energy Density Laboratory Plasmas will allow a significant expansion of this important research.

ADAPTING RESEARCH POLICY

Because technological innovation is so critical to our mission, we also need innovation in the research funding mechanisms we use across the Department. The Secretary, my colleagues and I believe the new funding mechanisms we have proposed – the Energy Frontier Research Centers, the Energy Innovation Hubs, and ARPA-E – will allow us to better integrate technical talent and research tools in the delivery of results the taxpayer cares about.

Scientific research has a number of important roles in a high tech economy, namely, integrating knowledge about the natural world into robust descriptions useable for engineering application; developing measurement tools and techniques; training a technically talented workforce; solving problems that arise in the design, manufacture or operations of complex technologies, and – what is most interesting to scientists themselves – the discovery of new phenomena. Engineering research is optimized to a different end, namely the design, manufacture and operations of complex technologies that deliver a desired function in an economically viable fashion. Existing funding mechanisms – such as the single investigator grant or the demonstration project to name two very different mechanisms the Department uses – are quite rationally optimized for the dominant activities of any given program. Our challenge is to identify that subset of opportunities where normal paths of advance can be bypassed and then bring together resources in new ways optimized for advancement.

I see a number of opportunities in the Department, through the application of concentrated, well-planned resources, to increase the relevance, impact and timeliness of both basic and applied research. Let me explain each of these mechanisms in relation to the traditional individual investigator grant of approximately $100,000 to $250,000 per year, a mechanism optimized for balancing opportunities for discovering new phenomena with delivering incremental scientific progress while training the technical workforce's next generation.

Energy Frontier Research Centers. The EFRCs are mainly university-based, problem-oriented research funded at the level of $2 million to $5 million per year. We use EFRCs where we have identified key scientific barriers to energy breakthroughs, and we believe we can clear these roadblocks faster by linking together small groups of researchers across departments, schools, and institutions. In FY 2011, the Department proposes using the EFRC model to pursue emerging opportunities by competitively soliciting in two categories: discovery and development of new materials critical to science frontiers and technology innovations, and basic research for energy needs.

Energy Innovation Hubs. The Hubs are concentrated, directed resources marshaled to support multidisciplinary, goal-oriented research. At $24 million per year, they are managed by top teams of scientists and engineers with the resources and authority to move quickly in response to new developments. We use the Hubs where we believe a problem is ripe for the side-by-side integration of discovery-oriented scientific research with translational engineering research so that opportunities for commercialization can be seized as early in the development life cycle as possible. For this reason, research supported through a Hub is ideally conducted under one roof.

The Hubs are modeled in large measure after the Bioenergy Research Centers (BRC), established with initial funding in 2007. The BioEnergy Science Center led by Oak Ridge, the Great Lakes BRC led by the University of Wisconsin at Madison, and the Joint BioEnergy Institute led by Berkeley Lab aim to make real steps toward practical solutions for the challenge of producing renewable, carbon-neutral energy. They do this by understanding how to reengineer biological processes to develop new, more efficient methods for converting the cellulose in plant material into ethanol or other biofuels that serve as a substitute for gasoline.

The Department has requested funding to continue the three Energy Innovation Hubs introduced in FY 2010. They focus on developing fuels that can be produced directly from sunlight, improving energy efficient building systems design, and using modeling and simulation tools to create a virtual model of an operating advanced nuclear reactor. In FY 2011, DOE is proposing a new Hub to focus on batteries and energy storage; the request of $34 million for this Hub includes one-time funding of $10 million for start-up needs, excluding new construction.

ARPA-E. ARPA-E is discovery-oriented, but this is a program on the hunt for new technologies rather than new scientific knowledge. We are seeking the boldest and best ideas for new, potentially transformative energy technologies and funding them to see if they work. To make this task even more challenging, it's not enough to fund transformational research that creates revolutionary technologies. ARPA-E is dedicated to the market adoption of those new technologies to meet the Nation's long-term energy challenges. The FY 2011 budget request includes $300 million for ARPA-E.

As you can see, not every scientific or technical challenge will be a good fit for all of these new mechanisms. Some of the largest scale technologies require so much "bent metal" that no one, not even the Federal government, has the resources to proceed other than carefully and incrementally. Other technologies await development in distant scientific or technical fields before they become ripe for development. And, a great deal of scientific and technical development proceeds along just fine using the traditional funding tools currently available to the Department.

OFFICE OF SCIENCE HIGHLIGHTS

As President Obama made clear in his remarks to the National Academy of Sciences in April 2009, the public sector must invest in research and innovation not only because the private sector is sometimes reluctant to take large risks, but because the rewards will be broadly shared across the economy. Leading requires assembling a critical mass of the best scientists and engineers to engage in mission-oriented, cross-disciplinary approaches to addressing current and future energy challenges balancing these activities against our ongoing quest to understand the most basic phenomena in the natural world. To develop clean energy solutions, maintain nuclear security and continue our discovery of nature, the Department must cultivate the science, technology, engineering, and mathematics workforce of the next generation.

The President's Plan for Science and Innovation commits to doubling Federal investment in basic research at select agencies, including the Office of Science. The Department continues its strong commitment to basic research and supports the President's Plan by requesting funding for the Office of Science at $5.1 billion, a 4.4 percent or $218 million increase from FY 2010.

The mission of the Office of Science is the delivery of scientific discoveries and major scientific user facilities to transform our understanding of nature and to advance the energy, economic, and national security of the United States. Science's responsibilities are in three main areas: selection and management of research; operation of world-class, state-of-the-art scientific facilities; and design and construction of new facilities. Just over 40 percent of the budget is devoted to funding research, with one third of that awarded to universities. Another 50 percent of the budget is devoted to the construction and operation of scientific user facilities used annually by about 26,000 researchers across the whole spectrum of physical and life sciences from academia, our labs, industry and other government agencies. The other program elements in the Science budget are Workforce Development for Teachers and Scientists, Science Laboratories Infrastructure, Safeguards and Security, and Science Program Direction. The program direction line funds the career Federal program managers and contract & grants specialists who are essential to the success of the Science program.

The Science program supports basic research in six major research programs. Advanced Scientific Computing Research advances computational and networking tools critical to research. Of equal importance is the applied mathematics, algorithm development and development of community simulation codes that the program supports. Basic Energy Sciences supports the materials science, chemistry, geosciences, and physical biosciences that form the foundations for new energy technologies and environmental mitigation technologies. The Biological and Environmental Research program supports biological systems science, climate change research and research to improve our understanding of the environmental consequences of energy production, development, and use. Fusion Energy Sciences develops the knowledge base for fusion as a potential future energy source. The High Energy Physics and Nuclear Physics programs support fundamental research aimed at understanding energy, matter, and the basic forces of nature.

Science participates in several ongoing crosscutting research programs authorized by Congress. These include:

- $191.2 million for the U.S. Global Change Research Program,
- $738.2 million for the Climate Change Technology Program,
- $461.9 million for the Networking and Information Technology Research and Development, and
- $323.9 million for the National Nanotechnology Initiative.

American Recovery and Reinvestment Act. Let me conclude by describing briefly how we have used the $1.6 billion the Office of Science received in the Recovery Act. We focused just over $500 million on advancing construction of existing scientific facilities projects or major items of experimental equipment that were baselined – approved at CD-3 in DOE parlance – and ready to go. The largest share for accelerated construction, $150 million, is dedicated to the National Synchrotron Light Source-II at Brookhaven National Laboratory. $130 million of the ARRA funds allows us to undertake needed infrastructure improvements across nine of Science's national laboratories. The lion's share for laboratory modernization is $60.6 million towards construction of the Chemical and Materials Sciences Building at Oak Ridge National Laboratory. We are investing $391 million to enhance operations and recapitalize scientific equipment at the Office of Science's existing major scientific user facilities. One of largest of those investments is $66.8 million to create a national-scale, 100-gigabit-per-second prototype data network. Not only will this enhance the Office of Science's ability to move large blocks of data between labs and universities effectively, it will also benefit the commercial telecommunications sector.

In allocating this one-time investment, we were careful to focus on preserving or creating jobs, positioning ourselves for future competitive advantage by spurring advances in the tools of science, and minimizing our out-year mortgages. The majority of the $599 million of Recovery Act for research, fellowships, and early career awards covers their full duration. For example 16 of the 46 of the Energy Frontier Research Centers were funded for their full 5 years with $277 million of Recovery Act funds. The remaining EFRCs were funded annually using the resources provided through our normal appropriation.

It would not have been possible to implement these programs with the scale, pace and quality achieved without the remarkable efforts of the career Federal staff in the Office of Science and its service centers in Chicago and Oak Ridge. They rose to the challenge of administering Science's Recovery Act funding alongside our regular appropriation without hiring any new Federal staff specifically for Recovery Act purposes. I also want to point out the heroic efforts of the staff of the Advanced Research Projects Agency – Energy (ARPA-E), who bootstrapped both a program and their organization from nothing a year ago January. They've already awarded $151 million of their $389 million to 37 radically innovative projects that, if successful, would accelerate transformation of the energy system.

Dr. Brinkman will discuss the request for the Office of Science in greater detail. With that, I would like to thank you for the opportunity to appear today and look forward to discussing the Department's priorities with you further.

Mr. BRINKMAN. Thank you. Thank you, Chairman Pastor, Ranking Member Frelinghuysen, and members of the committee. I am grateful for this opportunity to discuss the President's fiscal year 2011 budget request for science in the Department of Energy.

In his National Academy of Science address last April President Obama stated, "Science is more essential for our prosperity, our security, our health, our environment, and our quality of life than it has ever been before." These words continue to resonate. Today our Nation faces formidable challenges in energy and climate and national security and in maintaining America's competitive edge in an increasingly competitive world. Maybe that is an illustration of The New York Times.

As the President has emphasized, it will be impossible for our Nation to meet these challenges without the transformational power of science to provide us with the needed discoveries and tools. The President's plan for science and innovation envisions a 10-year doubling of funding at key Federal agencies, including the Office of Science.

It is a strategic investment in the future of our nation. Under the President's plan, the fiscal year 2011 budget funds the DOE Office of Science at $5.12 billion, an increase of 4.4 percent over the Fiscal Year 2010 and an important step towards the fulfillment of the President's historic commitment to doubling.

This budget will support path-breaking fundamental research in energy, helping to lay the foundation for our new 21st century energy economy. It will deepen our insight into challenging the phenomena of climate change. It will provide support for foundational discoveries about the physical world that are the wellspring and indispensable foundation of technological progress. It will sustain and expand our infrastructure of major scientific facilities, particle accelerators and colliders, the international ITER fusion facility, the world's most advanced suite of synchrotron light sources, the world's fastest super computers and state-of-the-art tools for genomics and systems biology. All of this is a critical backbone of American leadership in physical sciences.

The budget will also support the program direction account a specialized and highly skilled Federal oversight of the science investment, including program management, safety at our sites and a rigorous peer review system, which are very important to us. The budget will support researchers at all 17 DOE national laboratories. It is a collective scientific capability that is unmatched anywhere in the world. It will help maintain and build our scientific workforce and nurture and train the next generation of American scientists.

Some 27,000 investigators at more than 300 universities and other institutions across the Nation will be supported. In addition, some 26,000 researchers from across the country will rely on our major facilities. Indeed, research performed at four of our synchroton light sources figured in last year's chemistry Nobel Prize. Priorities of this budget request are closely aligned with those of our Nation. The request provides for the establishment of additional energy innovation hubs in the crucial area of battery and energy storage.

It provides enhanced support of climate modeling and observation. It expands on the successful Energy Frontier Research Centers Program by adding EFRCs in individual and small research investigator support in critical complementary areas to what we have today.

It continues to upgrade our leadership computing facilities, which now include the world's fastest computer, the Cray Jaguar at Oak Ridge National Laboratory. The request supports a new initiative in multiscale modeling of combustion and advanced engine systems. It builds out and upgrades our facility infrastructure.

Finally, it expands two important workforce development programs begun under the Recovery Act, providing 170 new awards under our graduate fellowship program and 60 new Early Career Research Program awards.

At a time when nations across the globe are investing heavily in R&D, and the world as a whole faces enormous challenges in energy and climate that ultimately only science can solve, the President's fiscal year 2011 budget request for the Office of Science is a critical investment in the future strength, prosperity and security of our Nation. Thank you.

Mr. PASTOR. Thank you, Doctor.

[The information follows:]

Statement of Dr. William F. Brinkman
Director
Office of Science
U.S. Department of Energy
Before the
Subcommittee on Energy and Water Development
Committee on Appropriations
U.S. House of Representatives

FY 2011 Appropriations Hearing
March 18, 2010

Thank you, Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee for the opportunity to testify today. I am pleased to appear before your Committee for my first budget presentation as Director of the Department of Energy's Office of Science. I would like to thank the Committee for your strong support of the Office of Science in recent years. This support has enabled the Office of Science to make investments in basic science and advanced research capabilities that are essential to improving U.S. competitiveness, energy security, the environment, and our fundamental understanding of the universe.

The FY 2011 budget request of $5.12 billion supports the President's Plan for Science and Innovation, which encompasses the entire Office of Science budget, as part of a strategy to double overall basic research funding at select agencies. As part of this plan, the FY 2011 request supports the training of students and researchers in fields critical to our national competitiveness and innovation economy, investments in areas of research critical to our clean energy future and to making the U.S. a leader on climate change, and unique facilities that keep the U.S. at the vanguard of science.

As you have heard from Secretary Chu and Under Secretary Koonin, science and technology lie at the heart of the Department of Energy's mission to solve our nation's most critical energy, environment, and national security challenges. The Office of Science plays a crucial role both for the Nation and the Department as a prime supporter of basic research spanning many disciplines of the physical and life sciences. The Department depends on the Office of Science to support the basic science that will enable transformative energy technologies and advance our understanding of climate change and the environment; the FY 2011 budget request supports new research initiatives for these critical priorities. The Office of Science budget has far-reaching impact in its direct support for investigators from more than 300 academic institutions and from all of the DOE laboratories. In total, the FY 2011 budget request will support about 27,000 scientists, engineers, students, and technicians across all fifty States.

The Office of Science also provides the Nation's researchers with state-of-the-art user facilities—the large machines of modern science. Increasingly, they are first-of-a-kind facilities that offer capabilities unmatched anywhere in the world and that enable U.S. researchers and industries to remain at the forefront of science, technology, and innovation. The 2009 Nobel Prize in Chemistry was awarded for work on the molecular structure of ribosome performed in part at the Office of Science's four x-ray synchrotron light sources—facilities that enable groundbreaking research by thousands of researchers annually. In total, nearly 26,000 researchers from universities, national laboratories, industry, and international partners are expected to use the Office of Science scientific user facilities in FY 2011. The FY 2011 budget request provides support for the construction, maintenance, and operation of the Office of Science user facilities.

The Office of Science is also one of the nation's primary supporters of the next generation of scientists and engineers. The Office of Science, through its six research programs, supports the training of undergraduates, graduate students, and postdoctoral researchers as an integral part of the ongoing sponsored research activities at universities and DOE national laboratories. Office of Science programs also support the development of individual research programs of outstanding scientists early in their careers to stimulate research careers in disciplines supported by the Office of Science. The FY 2011 request provides support to bring 60 new scientists into the Office of Science Early Career Research program and to double the number of graduate fellowships in basic science awarded through the Office of Science Graduate Fellowships program.

As the material that follows will explain, the Office of Science FY 2011 budget request of $5.12 billion is focused on accelerating the pace of discovery that addresses key national priorities. Our investments in fundamental science, unique world-leading research facilities, and outstanding researchers and students are aligned to advance our core missions.

Office of Science
FY 2011 President's Request
Summary by Program

(dollars in thousands)

	FY 2009 Approp.	FY 2009 Recovery Act Approp.[1]	FY 2010 Approp.	FY 2011 Request to Congress	FY 2011 Request to Congress vs. FY 2010 Approp.	
Office of Science						
Basic Energy Sciences	1,535,765	+555,406	1,636,500	1,835,000	+198,500	+12.1%
Biological and Environmental Research	585,176	+165,653	604,182	626,900	+22,718	+3.8%
Advanced Scientific Computing Research	358,772	+161,795	394,000	426,000	+32,000	+8.1%
High Energy Physics	775,868	+232,390	810,483	829,000	+18,517	+2.3%
Nuclear Physics	500,307	+154,800	535,000	562,000	+27,000	+5.0%
Fusion Energy Sciences	394,518	+91,023	426,000	380,000	-46,000	-10.8%
Workforce Development for Teachers and Scientists	13,583	+12,500	20,678	35,600	+14,922	+72.2%
Science Laboratories Infrastructure	145,380	+198,114	127,600	126,000	-1,600	-1.3%
Safeguards and Security	80,603	—	83,000	86,500	+3,500	+4.2%
Science Program Direction	186,695	+5,600	189,377	214,437	+25,060	+13.2%
SBIR/STTR (SC funding)[2]	104,905	+18,719	—	—	—	—
Subtotal, Office of Science	4,681,572	+1,596,000[3]	4,826,820	5,121,437	+294,617	+6.1%
Adjustments[4]	125,598	+36,918	76,890	—	-76,890	-100.0%
Total, Office of Science	4,807,170	+1,632,918	4,903,710	5,121,437	+217,727	+4.4%

---

[1] The Recovery Act Approp. column reflects the allocation of funding as of September 30, 2009 from the American Recovery and Reinvestment Act of 2009, P.L. 111-5.

[2] Reflects funding reprogrammed within the Science total to support the SBIR and STTR programs.

[3] $4,000,000 of the original $1,600,000,000 Recovery Act appropriation has been transferred to Departmental Administration for management and oversight.

[4] Adjustments include Congressionally-directed projects (FY 2009 and FY 2010), SBIR/STTR funding transferred from other DOE programs (FY 2009 and FY 2009 Recovery Act), and Congressionally-directed offsetting use of prior year balances (FY 2009 only).

Basic Energy Sciences

The Basic Energy Sciences (BES) program is the nation's lead sponsor of basic research needed to achieve transformational energy technologies. BES also supports the construction, operation, and maintenance of widely-used and impactful open-access scientific user facilities that advance a broad range of physical science directly relevant to the Department's energy mission.

The FY 2011 budget request supports investments in critical new areas for advanced energy. A centerpiece of this investment is the Energy Innovation Hubs. Modeled after the Office of Science Bioenergy Research Centers, the Energy Innovation Hubs focus on critical energy technology challenges by building creative, highly-integrated research teams that can accomplish more, faster, than researchers working separately. With your support, the Department launched the first three Hubs in FY 2010 with the Office of Science leading the Fuels from Sunlight Hub.

The FY 2011 request fully supports the first full year of operations of the Fuels from Sunlight Hub and proposes a new Energy Innovation Hub in BES for batteries and energy storage. The Administration's Energy Plan has two goals that require improvements in the science and technology of energy storage: 1. solar and wind providing over 25% of electricity consumed in the U.S. by 2025; and 2) 1 million all-electric or plug-in hybrid vehicles on the road by 2015. While batteries used in mobile (vehicles) and stationary (grid) applications differ in requirements for device size and weight, the critical scientific issues—electrodes, electrolytes and interfaces—that need to be addressed to advance these technologies are the same. Achieving technology breakthroughs in these areas requires understanding atomic and molecular processes that occur across these three components, which will in turn enable materials to be designed at the nanoscale, with architectures and functionalities to optimize charge storage and transfer.

Because the research challenges are inherently multi-disciplinary and the Administration has placed a priority on developing U.S. manufacturing capabilities in this area, the Hub approach is essential to accelerate progress towards achievement of our goals as rapidly as possible. The Batteries and Energy Storage Hub will target science knowledge gaps that are preventing breakthroughs in technology platforms for both grid and mobile applications. The Hub will expand our scientific base for synthesis of novel nanoscale materials with architectures tailored for specific electrochemical performance; will develop new methodologies to characterize materials and dynamic chemical processes at the atomic and molecular level; and will expand our competencies in simulation and prediction of structural and functional relationships using modern computational tools.

Following the successful launch of 46 Energy Frontier Research Centers in FY 2009 with FY 2009 appropriated funds and American Recovery and Reinvestment Act funds, the FY 2011 request makes a substantial new investment to support single investigators, small groups, and additional Energy Frontier Research Centers in several areas critical to energy innovation. Specifically, BES is moving aggressively to recapture U.S. leadership in the rapidly expanding area of materials synthesis. These funds will also be used to support fundamental science related to carbon capture and advanced nuclear systems. Specific focus areas will include the rational design of novel materials and separation processes for post-combustion CO_2 capture in existing power plants and catalysis and separation research for novel carbon capture schemes to aid the design of future power plants. Research for advanced nuclear energy systems will focus on radiation resistant materials in fission and fusion applications, and separation science and heavy element chemistry for fuel cycles.

The FY 2011 budget also enables a new initiative to develop the science base for computational design of advanced engines. Predictive simulation of combustion in an evolving fuel environment is essential for developing more efficient and cleaner engines. This new BES activity, in concert with its ongoing collaboration with the Office of Energy Efficiency and Renewable Energy's Vehicle Technology Program, will provide a new paradigm for simulation of the complex physical processes that govern combustion. Through robust partnership with industry, the program will seek to build a set of capabilities that will give U.S. industry a competitive advantage in reducing the cost to design and produce advanced engine designs.

The FY 2011 budget also transfers the gas hydrates from the Office of Fossil Energy to the Office of Science. BES research will investigate fundamental scientific questions about methane hydrates: their formation and occurrence; their stability in natural or engineered systems; their role in geological/ ecological systems; and their role in the carbon cycle. The program will also study hydrates via controlled in situ depressurization and physical, thermal, and chemical stimulation of hydrate formations in the Arctic and the Gulf of Mexico. This research will be supported by theory and multi-scale modeling and simulation in areas such as the intermolecular forces that govern the structure and properties of gas hydrates.

The FY 2011 budget continues support for core research programs in materials sciences and engineering critical to the development of materials that improve the efficiency, economy, environmental acceptability, and safety of energy generation, conversion, transmission, storage, and use; research in chemistry and physics underpinning advances in efficient combustion systems with reduced emissions of pollutants, new solar photoconversion processes, improved catalysts for the production of fuels and chemicals, and better separations and analytical methods for applications in energy processes, environmental remediation, and waste management; research in geosciences for advanced monitoring and measurement techniques for reservoir definition and improved understanding of the fluid dynamics of complex fluids through porous and fractured subsurface rock; and research in the molecular and biochemical nature of photosynthesis for the development of solar photo-energy conversion.

The FY 2011 budget request provides continued support for the operations of the suite of BES scientific user facilities, including five x-ray light sources, three neutron sources, and five nanoscale science research centers. These facilities provide key capabilities for the fabrication of novel materials, for the examination of materials and their transformations at the atomic scale, and to enable scientists to correlate microscopic structures to macroscopic properties.

The Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory will begin the first full year of operations in FY 2011. LCLS is the Office of Science's newest x-ray light source user facility, providing an unprecedented combination of high spatial and temporal resolution for the investigation of atomic-scale structure and processes with brightness 10 orders of magnitude beyond conventional x-ray sources. The LCLS is on target for an on-time, within-budget completion in FY 2010; the time between first start up and first light last April was under two hours, a remarkable achievement for a first-of-its kind machine.

The construction of the National Synchrotron Light Source II (NSLS-II) will continue at Brookhaven National Laboratory, including the largest component of the project—the building that will house the accelerator ring. When complete, NSLS-II will be a new synchrotron light source highly optimized to deliver ultra-high brightness and flux with exceptional beam stability and high-resolution, serving a large number of concurrent users. By contrast, LCLS operates with a laser-like intensity that is approximately ten orders of magnitude higher than NSLS-II and is capable of high-resolution studies of individual chemical reactions.

Biological and Environmental Research

The Biological and Environmental Research (BER) program supports world-leading research exploring the frontiers of genome-enabled biology; discovering the physical, chemical, and biological drivers and environmental impacts of climate change; and seeking the geochemical, hydrological, and biological determinants of environmental sustainability and stewardship.

The FY 2011 budget request supports substantially enhanced activities in climate research to improve our predictive capability. While the demands on climate change modeling to inform policy and investment decisions are increasing, the current state of climate models is insufficient to predict with detail and accuracy the future interactions between climate change and human activity. Improving the precision and accuracy of climate models is therefore of paramount importance. The FY 2011 budget increases in BER support the development of a predictive capability that will rapidly incorporate new science into state-of-the-art climate models and that will improve uncertainty quantification.

These new and enhanced activities will emphasize research and atmospheric data collection for improving representation of the feedbacks produced by the indirect effect of aerosols; enhanced uncertainty quantification for climate model simulations and predictions; conversion of observational data sets into specialized, multi-variable data sets for Earth System Model testing and improvement; model development testbeds in which model components can be rapidly prototyped and evaluated using integrated observational datasets; and development of numerical methods to enable climate models to use future computer architectures.

The FY 2011 request also supports continuing climate research efforts to develop an additional large-scale, manipulative experiment in the arctic tundra to improve understanding of the impacts of climate change on ecosystem structure and function. Research will be expanded to improve understanding of the role of terrestrial ecosystems as sources and sinks of greenhouse gases. These efforts will focus on the role of natural processes that control terrestrial carbon sequestration and how those processes might be managed to enhance carbon sequestration in terrestrial ecosystems. Atmospheric system research and operation of new Atmospheric Radiation Monitoring (ARM) Climate Research Facility instruments will provide critical data for improving representation of clouds and aerosols in climate models.

The FY 2011 request provides strong support for genomic science research, including the DOE Bioenergy Research Centers (BRCs) and the Joint Genome Institute (JGI). In only their third year, the BRCs have already pioneered new approaches to accelerate biofuels research. The BRCs will continue to advance our understanding of how plant and microbial system functions are specified by genome organization, expression, and regulation. This includes developing genomic, analytical, and computational approaches to study the structure, interdependence, and function of microbial communities and the identification of plant traits for improved bioenergy production or carbon sequestration. The JGI will continue to support the sequencing needs of the Genomic Science program, especially the Bioenergy Research Centers. Sequencing the 3 billion base-pair human genome took 13 years and multiple national and international partners. Today JGI sequences a trillion base pairs of DNA annually and has significantly expanded its role in large-scale genome sequencing and analysis, including enhanced data analysis tools for sequencing microbial communities. JGI activities will reflect the steady increase in production DNA sequencing as well as the resulting need for high-throughput, complex genome annotation and analysis.

The FY 2011 budget request also supports basic research on the fate and transport of contaminants in the subsurface. This research addresses unique physical, chemical, and biological processes controlling the flux of contaminants across and within the root zone of soils and the flux of contaminants to surface water bodies. Processes in these critical zones influence fluxes of carbon and key nutrients between the atmosphere and terrestrial biosphere. Support for updated equipment at the Environmental Molecular Sciences Laboratory (EMSL), including enhancement of leading capabilities in proteomics and advanced magnetic resonance, will sustain EMSL's position as a state of the art scientific user facility.

Advanced Scientific Computing Research

The United States currently leads the world in supercomputing capabilities. ASCR's Jaguar Supercomputer at Oak Ridge National Laboratory ranks #1 of the world's fastest computers. By pushing the boundaries of computation, modeling, and simulation, ASCR research is changing the landscape for scientific discovery and promoting an area of technical leadership for America.

The FY 2011 ASCR budget request capitalizes on continued gains in computer hardware and computational science, and positions DOE to address scientific challenges through modeling and simulation in the next decade. The coming decade will see increases in computing capabilities of a factor of 1000—the so-called exascale of computing. Continued support for existing facilities and programs broadens the number of applications and users with access to leadership scale computational capabilities, while new investments anticipate the ever growing need for enhanced computational capabilities in a number of critical science applications.

The FY 2011 budget request continues support for the Leadership Computing Facilities at Oak Ridge National Laboratory (OLCF) and Argonne National Laboratory (ALCF). Supercomputing systems at both facilities are openly available to the scientific community through the Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program, and provide access and assistance to tool and library developers and to researchers seeking to scale their application to this new realm of computing power—critical activities for harnessing the complexity of this and future architectures.

The FY 2011 budget request also includes site preparation and acquisition activities at Argonne National Laboratory for a next generation machine with approximately five times the current capacity of the Jaguar machine at Oak Ridge; and provides for the acquisition of an experimental prototype machine at Oak Ridge National Laboratory with a hybrid architecture offering greater efficiency and computing power but also new programming challenges. By actively participating in the development of these next-generation machines, we ensure that the most appropriate architectures for science are developed, and allow researchers to get a head start on understanding and overcoming the challenges of these new designs.

The National Energy Research Scientific Computing Center (NERSC) facility at Lawrence Berkeley National Laboratory (LBNL) will operate at a capacity of nearly one quadrillion operations per second (roughly half the capacity of the Jaguar machine) in FY 2011 to meet ever growing demand from Office of Science researchers. The NERSC focus will be on assisting applications to effectively utilize the potential of this facility and to move beyond NERSC to the leadership computing machines.

Building on the Recovery Act-supported Advanced Networking Initiative, the Energy Sciences Network (ESnet) will deliver 100–400 gigabit per second (Gbps) connections to Office of Science laboratories in FY 2011, with a goal of achieving 1,000 Gbps connectivity in 2014. These increases in bandwidth are necessary to move massive amounts of data to and from the supercomputing facilities and from other research facilities such as the Large Hadron Collider at CERN and Spallation Neutron Source. The ESnet is also critical to effective utilization of the growing amounts of data in climate research, nuclear structure, genomics, and proteomics that advance DOE's energy and environment missions.

The FY 2011 budget continues the critical research efforts in Scientific Discovery through Advanced Computing (SciDAC) and the core research programs in Applied Mathematics and Computer Science. These investments enable scientists to effectively utilize the capabilities of the Leadership Computing Facilities and beyond. Core research in Applied Mathematics and Computer Science for FY 2011 will continue to focus on long-term research needs. In networking, the focus will continue to be on developing the advanced tools to harness the growing capabilities and requirements of the ESnet and the SC research community.

High Energy Physics

The High Energy Physics (HEP) program supports investigations at the far reaches of our knowledge of matter, energy, and the universe. HEP-supported researchers explore the *energy frontier* with powerful particle accelerators designed to discover as-yet-undetected particles, search the *intensity frontier* with accelerator and reactor systems specifically designed to detect rare subatomic events, and investigate the *cosmic frontier* with detectors in space, on the earth's surface, and underground.

The FY 2011 HEP budget request continues support for unique domestic research facilities and partnerships to ensure that the U.S. will continue to lead the search for the Higgs Boson—whose existence is predicted by the Standard Model of high energy physics—through Fiscal Year 2011. The request also supports investments in proposed new experiments that will position the United States for a world leading program at the intensity frontier of particle physics in the next decade.

The primary scientific goals at the *energy frontier* over the next five years are to enable discoveries of, for example, the Higgs boson and supersymmetric particles—either at the Tevatron or the Large Hadron Collider (LHC) at CERN. The Fiscal Year 2011 HEP budget request continues support for operation of the Tevatron Collider at Fermi National Accelerator Laboratory because Tevatron's record-breaking performance in delivering data over the last few years means that it will remain competitive with the LHC for significant discoveries throughout FY 2011. Experiments at the Tevatron systematically search for the Higgs boson. Continuing operations through FY 2011 will allow researchers to thoroughly explore the most likely mass ranges where the Higgs is expected to be found.

The FY 2011 budget request also provides for the U.S. LHC program, which supports researchers in the U.S., at universities and national laboratories, to build components for the LHC, design experiments, analyze experimental data, and host data centers here at home. Fermi National Accelerator Laboratory hosts the Tier 1 computing center for the Compact Muon Solenoid experiment at the LHC, and Brookhaven National Laboratory hosts the Tier 1 computing center for the LHC ATLAS experiment.

Following the guidance of the Particle Physics Project Prioritization sub-panel of the High Energy Physics Advisory Panel (the "P5 Report"), Fermi National Accelerator Laboratory is preparing to shift its primary science focus to the *intensity frontier*. Using incredibly intense source beams of particles and highly sensitive detectors, scientists can increase their ability to observe rare interactions among the most fundamental constituents of matter, and characterize one of the most elusive particles—the neutrino. The FY 2011 HEP budget request advances a suite of experiments employing these techniques at the so-called *intensity frontier* of particle physics. This includes project engineering and design for the proposed Long Baseline Neutrino Experiment (LBNE) and Muon to Electron Conversion Experiment, both of which will leverage existing infrastructure at Fermi National Accelerator Laboratory along with new technologies. The LBNE project, which proposes to examine properties of the neutrino particle that could help explain why there is more matter than anti-matter in the universe, is being developing by the Office of Science in coordination with the National Science Foundation. The NSF is considering the development of a Deep Underground Science and Engineering Laboratory (DUSEL) in an old gold mine in South Dakota -- an potentially attractive location for the large LBNE far neutrino detector. The Muon to Electron Conversion Experiment promises insights into the relationship between the fundamental forces of matter. Sustained investment in these domestic facilities will ensure a leading role for the US at the Intensity Frontier.

The FY 2011 budget request also supports DOE partnerships with NASA and NSF in world class, space-based and ground-based particle astrophysics observatories for exploration of the *cosmic frontier*. HEP and NASA are presently jointly supporting analysis of data from NASA's Fermi Gamma-ray Space Telescope that detects gamma-rays emanating from astrophysical sources, and HEP continues support for commissioning and integration activities for the Alpha Magnetic Spectrometer experiment which is on NASA's Space Shuttle manifest for launch in 2010. HEP is collaborating with NSF on experiments using ground-based observatories, including the Baryon Oscillation Spectroscopic Survey, which is currently operating, and the Dark Energy Survey, currently in fabrication, and on research and development aimed at developing large, next-generation telescopes that can significantly advance our knowledge of dark energy. HEP and NASA continue to work together to consider the possibility of developing a space-based Joint Dark Energy Mission that would complement and extend the ground-based measurements. HEP will also continue to collaborate with NSF on a phased program of research and technology development that is designed to directly detect dark matter particles using ultrasensitive detectors located underground.

The FY 2011 request also supports U.S. efforts in developing the technologies for more powerful and improved accelerators, and more accurate and sensitive detectors. The request supports Advanced Technology research and development for the most promising accelerator and detector technologies, including operations of two new advanced technology test facilities.

Nuclear Physics

The Office of Science is charting new directions at the frontiers of nuclear science: advancing our knowledge of the world and leading to applications in energy research, medicine, national security, and isotopes for a wide variety of purposes.

The Fiscal Year 2011 Nuclear Physics (NP) budget request provides for enhancements, upgrades, and construction of high priority scientific user facilities. This budget supports an increase in operations for the Relativistic Heavy Ion Collider (RHIC)—the only machine in the world colliding heavy ions at near light speed. Researchers at the RHIC facility recently announced the experimental discovery of a quark-gluon plasma—a remarkable new form of matter thought to have filled the very early universe.

In FY 2011, construction continues for the upgrade to the Continuous Electron Beam Accelerator Facility (CEBAF)—the world's most powerful probe for studying the nucleus of the atom. The Nuclear Science Advisory Committee identified the 12 GeV CEBAF Upgrade as the highest priority in their long-range plan. This upgrade will enable scientists to better understand the mechanism for quark confinement, which prevents quarks from being observed independently.

Engineering and design efforts for the Facility for Rare Isotope Beams (FRIB) continue in FY 2011 consistent with the project profile. FRIB will probe the properties of rare nuclear isotopes found in the universe to better understand the origin of the elements and fundamental symmetries of nature.

Stable and radioactive isotopes are vital to the mission of many Federal agencies and play a crucial role in basic research, medicine, industry, and homeland defense. The FY 2011 NP budget request continues support for Isotope Development and Production for Research and

Applications to support research, development, and production of research and commercial isotopes that are of critical importance to the Nation and in short supply.

Fusion Energy Sciences

The Fusion Energy Sciences (FES) program is the primary supporter of U.S. research to expand the fundamental understanding of plasmas and matter at very high temperatures and densities, and to lay the scientific foundations needed to develop a fusion energy source. Fusion has the potential to provide an energy source that is virtually inexhaustible and environmentally benign, producing no combustion products or greenhouse gases.

The FY 2011 budget request maintains the U.S. commitment to ITER, the flagship international fusion research project being constructed in Cadarache, France, that will realize self-sustaining "burning" plasmas for the first time. Burning plasma physics as it will be explored on ITER is both a grand scientific challenge and an undertaking of tremendous practical import to demonstrate the scientific and technological feasibility of sustained fusion power. What we learn through ITER will guide our choices in the development of a subsequent demonstration power plant. Like all non-host Members, the U.S. share for ITER's construction is 1/11 (9.09%) of the total value estimate and guarantees the U.S. full participation in and access to the ITER scientific program; roughly 80% of the U.S. share will be in-kind components manufactured by U.S. industry.

Over the past several months, a schedule has been developed and agreed upon by all participating countries. A cost estimate will be generated in early May and all countries are expected to agree to the combined scope, schedule, and cost in early June. In addition, the project is working hard to improve its management structure. The U.S. fully supports all of these activities. The reduction of the request for ITER in FY 2011 compared to the FY 2010 appropriated level is a reflection of the pace of ITER construction as of the end of 2009. The FY 2011 funding request will be used to make substantial progress on all of the design, R&D, and long-lead procurement activities for the U.S. hardware contribution. The United States will continue funding the Construction Phase of the ITER Project including research and development of key components, long-lead procurements, and contributions of personnel and funds to the ITER Organization (IO).

The FY 2011 budget request supports an expansion of research efforts in the emerging science of high energy density laboratory plasma (HEDLP)—the study of ionized matter at extremely high density and temperature. HEDLP science is enabling deeper understanding of extreme phenomena in a range of disciplines including fusion energy science, condensed matter physics, materials science, fluid dynamics, nuclear science, and astrophysics. The requested increase in the FES HEDLP program will enable new research awards under the HEDLP joint program between FES and the National Nuclear Security Administration (NNSA), which began in FY 2009. This research will leverage world-class FES and NNSA facilities to provide information in assessing the viability of inertial fusion energy as a future energy source; first-of-kind laboratory studies of astrophysical phenomena that include testing of models used to infer the age of the universe; and opportunities for junior researchers to ensure continued excellence in scientific disciplines closely aligned with fusion energy science and stockpile stewardship

The FY 2011 request continues support for research at the major U.S. experimental fusion facilities—DIII-D, Alcator C-Mod, and NSTX. These facilities will continue to focus on building the predictive science needed for ITER operations and providing solutions to high-priority ITER technical issues. More specifically, these facilities will conduct experiments to improve active control of various plasma parameters, measure the effects and mitigation of disruptions in the plasma, and develop a scientific basis of advanced operating scenarios for ITER. Recent advances at our domestic facilities have had significant and direct positive impacts on the ITER design.

The FY 2011 request also supports the transition of the Fusion Simulation Program (FSP) from its 2-year (FY 2009-FY 2010) planning phase to the full program. The FSP is a computational initiative led by FES with collaborative support from the Office of Advanced Scientific Computing Research (ASCR). It is aimed at the development of a world-leading, experimentally validated, predictive simulation capability for fusion plasmas in the regimes and geometries relevant for practical magnetically confined fusion energy.

The FY 2011 budget also continues support for the Plasma Science Centers (PSCs), multi-institutional research teams dedicated to solving critical challenges in basic plasma science. In addition to the science that is fostered in this research, the education and training of plasma scientists is a major goal of this program.

Workforce Development for Teachers and Scientists

The Workforce Development for Teachers and Scientists (WDTS) program contributes to the national effort that will ensure that DOE and the Nation have a sustained pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.

Workforce Development for Teachers and Scientists (WDTS) is implementing the DOE Office of Science Graduate Fellowship (DOE SCGF) program to encourage talented students to pursue research-focused graduate studies in physics, chemistry, biology, mathematics, computer science, engineering, and environmental science.

In FY 2011, WDTS increases funding for the DOE Office of Science Graduate Fellowship program to support a second cohort of students who will pursue advanced science and engineering degrees in fields of basic research relevant to the DOE mission.

The FY 2011 request also establishes a Science of Science Policy initiative focused on developing improved data, tools, and methods to assess the effectiveness of investments in science.

Science Laboratory Infrastructure

The Science Laboratories Infrastructure (SLI) program mission is to support scientific and technological innovation at the Office of Science laboratories by funding and supporting mission-ready infrastructure and fostering safe and environmentally responsible operations. Paramount among these is the provision of infrastructure necessary to ensure world leadership by the Office of Science national laboratories in the area of basic scientific research now and in the future.

In Fiscal Year 2011, the Science Laboratory Infrastructure program is focused on an ongoing Infrastructure Modernization Initiative. We completed and initiated several construction and general plant projects with Recovery Act funds. The initiative currently includes 35 projects across 10 laboratories. Five ongoing construction projects will continue in FY 2011, and, with several projects coming to completion in FY 2010, two new line item construction projects will be initiated in FY 2011. Although the budget remains constant, new projects will be initiated as current projects are completed.

Safeguards and Security

The Safeguards and Security (S&S) program supports the Departmental research missions at Office of Science laboratories by ensuring appropriate levels of protection against unauthorized access, theft, diversion, loss of custody, destruction of Department assets, or hostile acts that may cause adverse impacts on fundamental science, national security, and the health and safety of DOE and contractor employees, the public, and the environment.

The FY 2011 budget request maintains S&S activities at the current level of effort in the Office of Science laboratory complex in the following areas: protective forces, security systems, information security, cyber security, personnel security, material control and accountability, program management, personnel, and policy, oversight, and administration to establish the requirements associated with the preceding activities.

Science Program Direction

The mission of the Science Program Direction (SCPD) program is to support and sustain a skilled and motivated Federal workforce that oversees the Office of Science investments in world-leading scientific research. The Office of Science workforce is responsible for developing and shaping the science program, executing and managing science funding, and overseeing construction of large scientific user facilities. Oversight includes the health and safety of the workforce and overall security requirements. Additionally, the Federal workforce provides administrative, business, legal, and technical management of research grants and contracts, the oversight of the management and operating (M&O) contracts for the 10 Office of Science DOE national laboratories, and public access to DOE's research and development results.

Over the last several years the Science Program Direction (SCPD) budget and workforce have not kept pace with increase in workload associated with recent increases in the total Office of

Science budget. The Fiscal Year 2011 SCPD budget request closes this gap and helps to address the challenges associated with new program activities.

In FY 2011, the average research portfolio managed by a headquarters Program Manager will have increased almost 30% over the FY 2009 level. The Integrated Support Center processed and managed over 4,800 award actions in FY 2009; this number has doubled in the last 7 years and is anticipated to continue to increase as the SC research budget grows. In FY 2009, over 4,000 hours of overtime were logged by Office of Science staff. Furthermore, new program oversight will be needed for Energy Frontier Research Centers, the Energy Innovation Hub, SC Graduate Fellowships, and the SC Early Career Research Program. The FY 2011 budget request will provide the resources required to ensure fulfillment of the Office of Science mission.

Conclusion

I want to thank you, Mr. Chairman, for providing this opportunity to discuss the Office of Science research programs and our contributions to the Nation's scientific enterprise and clean energy future. On behalf of the Department, I am pleased to present this FY 2011 budget request for the Office of Science.

This concludes my testimony. I would be pleased to answer any questions you might have.

Mr. MAJUMDAR. Mr. Chairman, Ranking Member Frelinghuysen, and distinguished members of the subcommittee. I am delighted to appear before you today and testify as the first director of the Advanced Research Projects Agency-Energy or ARPA–E. I want to thank Congress for authorizing ARPA–E in the America COMPETES Act and appropriating $400 million for the Recovery Act of 2009. ARPA–E is about 1 year old. I will now provide a report of how we have done so far, an overview of the President's fiscal year 2011 budget request for $300 million and explain how we plan to operate in the future.

ARPA–E is a small, agile, risk tolerant and goal-oriented organization of highly motivated and talented individuals with a singular mission, to integrate science and engineering and rapidly innovate to create new disruptive energy technologies.

We invest in high risk, high reward research projects that the private sector finds too risky to invest in with the knowledge that if one or a few of these technologies are successful, they would create large new business opportunities that would ensure U.S. technological lead, economic health and energy security while reducing greenhouse gas emissions.

The first round of funding opportunity announcement received an overwhelming response from the technical community, 3,700 concept papers, proposal papers, 340 full proposals and after a total review process, 37 proposals selected for award at an average of $4 million each over 3 years. These projects were selected based on the impact of our mission, innovative technical approaches, superb teams, opportunities for the U.S. to gain leadership and to pursue technologies that are underserved by other parts of DOE and the private sector.

The $151 million of ARPA–E investment in this round catalyzed an additional $33 million in investments in 2 months, mostly from the private sector. Equally important, ARPA–E negotiated all 37 awards in less than 2 months, which includes three technology investment agreements based on other transactions' authority.

While the first round received a very high level of interest, the large oversubscription meant there were many innovative ideas that we could not support with funding. We are bringing many of those teams back to ARPA–E through workshops and new programs. The second round, with an allocation of $100 million, drew on lessons learned from these workshops and are focusing on advanced batteries for transportation, new materials and processes for carbon capture and new ways of generating transportation fuels from hydrogen, carbon dioxide and electricity.

The third round, with an allocation of $100 million, was announced March 3 and will focus on grid level electricity storage, new efficient cooling technologies for buildings and a whole new power electronics platform for enabling renewable electricity generation, LED lighting, vehicle electrification and the electricity distribution system. The goal of these rounds is either to identify technologies that will be disruptive for today's approaches or to create technologies where none currently exist.

ARP–E planned and organized in a span of 2 months the first energy innovation summit held in Washington D.C. from March 1 to 3. The response was overwhelming. We had almost 1,700 participants, spanning all stakeholder communities, many of which do not often come together. These include scientists and engineers, entrepreneurs, small and large business CEOs and CTOs, technology investors from the venture community, as well as investment banks, policy researchers and NGOs.

We invited not only the technologies that is ARPA-E funded in the first round, but also those that we could not fund and gave them the opportunity to showcase their technologies to other investors. We have been told that many financial deals were actually made. ARPA–E will continue to act as a catalyst for this innovation ecosystem, and we hope you will join us in next year's event.

I have three priorities, for next year, A, recruit the best people; B, provide top leadership to create new programs and invest in the best ideas and teams; and, C, engage with the private industry in ARPA–E technologies. I am happy to report that we have hired and are continuing to hire some of the best talent in the technical community, a rare breed who are the best-in-class active researchers with one foot in science and engineering and the other in technology development and business. These individuals will spend 3 years in ARPA–E and then leave. This rotation will allow us to keep bringing in new talent and a freshness of ideas in ARPA–E.

We plan to issue 10 to 12 funding announcements in fiscal year 2011. The final topics will be based on several workshops that we plan to gather input from the technical community about the state-of-the-art, the key technical barriers and what may be possible if we innovate. The program topic areas are outlined in my written statement and span topics such as solar electricity generation at three to four times lower cost than today, waste heat utilization and reduced energy consumption in industrial processes like steel, cement, paper, glass and aluminum manufacturing. I have described the process of how these programs will be created and executed.

ARPA–E has an innovative organizational model that promotes internal debate and collaboration between technology pushers and pullers, with one foot in the world of science and the other in energy markets.

This model naturally allows us to partner both with the Office of Science as well as the applied energy offices.

Furthermore, I have created a panel of senior technical advisers for ARPA–E, which consists of technical leaders from DOE from all these offices. Our goal is to closely coordinate, create feedback loops and leverage each other to form a coherent and smooth innovation pipeline for the DOE.

From what I have seen so far, I am very optimistic about our Nation's ability to innovate the future. I am honored to have the opportunity to serve the Nation with a very talented, dedicated and fearless team at ARPA–E, and I once again thank you for your support.

Mr. PASTOR. Thank you very much for your testimony.

[The information follows:]

Statement of

Arun Majumdar

Director

Advanced Research Projects Agency-Energy (ARPA-E)

U.S. Department of Energy

Before the

Subcommittee on Energy and Water Development

Committee on Appropriations

U.S. House of Representatives

March 18, 2010

Good morning Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Subcommittee. Thank you for the opportunity to testify today on behalf of the Advanced Research Projects Agency-Energy (ARPA-E). As the first Director of ARPA-E, I am also grateful for the opportunity to create an organization within the Department of Energy (DOE) with the following mandate:

1. To bring a freshness, excitement, and sense of mission to energy R&D that will attract the U.S.'s best and brightest minds—those of experienced scientists and engineers, and, especially, those of students and young researchers, including those from the entrepreneurial world;
2. To focus on transformational energy research that industry by itself cannot or will not support due to its high risk but where success would provide dramatic benefits for the nation;
3. To utilize DARPA-like organization that is flat, nimble, and sparse, capable of sustaining for long periods of time those programs whose promise remains real, while phasing out programs that do not prove to be as promising as anticipated; and
4. To create a new tool to bridge the gap between basic energy research and development/industrial innovation.

ARPA-E's mission is to:

1. Reduce energy imports and improve energy efficiency
2. Reduce energy-related emissions, especially greenhouse gases;
3. Ensure U.S. technological lead in developing and deploying advanced energy technologies.

We have recruited some of the best and brightest from the technical community to form a small team at ARPA-E, and it has been incredibly exciting for me and my team to create this new organization. Prior to my current job, I was a Professor of Mechanical Engineering and Materials Science and Engineering for 13 years at the University of California, Berkeley, as well as a scientist and the Associate Laboratory Director for Energy and Environment at the Lawrence Berkeley National Laboratory. I have been involved in R&D for the last 25 years and am an elected member of the National Academy of Engineering.

I appear before you today to provide an overview of the President's Fiscal Year 2011 budget request of $299.996 million for ARPA-E, explain how we plan to operate in the future, and provide a report of how we have done so far.

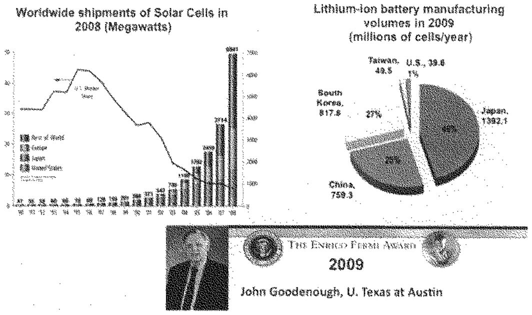


Figure 1. (Left) Global comparison of solar cell shipments. Source: PV News, April 2009. (Right) Global distribution of manufacturing volume of Lithium-ion batteries in 2009 (pre-ARRA funding). John Goodenough was awarded the Enrico Fermi Award, DOE's highest award, for inventing the modern Li-ion battery.

Introduction

We are living through the "Sputnik moment" of our generation. Our dependence on fossil fuels threatens our energy and environmental security and we must step up our clean energy efforts. Business as usual is not a viable option. Conversely, taking swift action on energy is a tremendous economic opportunity to lead in what Secretary Chu has called another industrial revolution. We as a nation need to change course with fierce urgency.

To illustrate this point, I have included two snapshots of production that are key to future energy use. Figure 1 (above) shows the trends in US market share and shipments of photovoltaic solar cells. In a span of 15 years, the US market share has decreased from 45 percent to less than 10 percent. It is worth noting that the modern solar cell was invented at Bell Labs, a US company. Figure 1 also shows that the US had one percent of the manufacturing volumes of Lithium-ion batteries in 2009 (pre-American Recovery and Reinvestment Act of 2009 investments). It is also worth noting, and ironic, that the modern Lithium-ion battery, like the modern solar cell, was also invented in the US, and Professor John Goodenough received the 2009 Enrico Fermi award from the DOE for doing so.

ARPA-E was created to accelerate the pace of innovation in energy technologies. The projects it supports are to have a high impact on its mission and would lead to new and game-changing global business opportunities. Given the magnitude of the challenge and opportunity and the investments in clean energy overseas, the next few decades have to be the most innovative period of our history.

Where we are now

The National Academies released a 2005 report, "Rising Above the Gathering Storm," that included the recommendation to establish an Advanced Research Projects Agency—Energy within the DOE. In August of 2007, Congress passed the America COMPETES Act which authorized the program. President Barack Obama announced the launch of ARPA-E on April 27, 2009, as part of a sweeping announcement about federal investment in research and development and science education. The Recovery Act provided $400 million in funding for ARPA-E.

Now that the first tranche of those funds have been awarded, I would like to provide a report of where we are today. The first funding opportunity announcement (FOA) was open to all energy technologies. It received an overwhelming response from the technical community – 3,700 concept papers, 340 full applications, and, after a thorough review process, 37 projects were selected. Each award averaged $4 million over a project life of two to three years for a total of $151 million in selections. These projects were selected based on the impact on ARPA-E's mission, innovative technical approaches, superb teams, opportunities for the US to gain leadership and to pursue technologies that are underserved by other parts of DOE and the private sector. If successful, these technologies could be game-changing and launch new opportunities for American businesses and jobs.

While the first FOA round was a clear success, the large oversubscription meant there were many innovative ideas that we could not support with current funding. We invited back many diverse teams we did not fund to ARPA-E workshops where we brainstorm on the most promising opportunities for high impact program areas and optimal program structures, and we base many of our forthcoming funding opportunities on these. Learning from the first FOA round about topics that showed significant depth of innovations, a series of workshops focused on specific topics such as energy storage and carbon capture. The second FOA round was announced Dec 7, 2009 for $100 million and selected projects are expected to be announced in early May 2010. This FOA round also drew on lessons from workshops and is focused on advanced batteries for transportation (BEEST), new materials and processes for carbon capture (IMPACCT), and new ways of generating transportation fuels from hydrogen, carbon dioxide, and electricity (Electrofuels). To date, these three programs have received a total of 500 concept papers. While it suggests significant oversubscription given the focused nature of these programs, it also shows that the scientific community is ready to take up the challenge for addressing some aggressive performance and cost targets identified in these programs. The selected projects from the third FOA round, issued March 2, 2010 for $100 million are expected to be announced in early July 2010. The third round is focused on energy efficient cooling technologies for buildings (BEETIT), grid-scale electricity storage (GRIDS), and devices/systems for power electronics with applications spanning integrating renewable power to the grid at low cost, efficient lighting in buildings, power management in hybrid-electric automobiles, and power management in computing devices (ADEPT).

The goals of the funding opportunities are (a) to either identify technologies that will leapfrog over today's approaches or to create technologies where none currently exist, (b) to focus on identifying projects that are too risky for the private sector to invest in, and (c) to invest in multiple competitive approaches to reach the same goals. We do not expect all the selected projects to work, but we expect at least a few of them to be game-changing. Furthermore, we expect the private sector to pick up these technologies where we leave off and scale them to create new business opportunities.

ARPA-E Energy Innovation Summit

ARPA-E planned and organized—in a span of two months—the first Energy Innovation Summit held in Washington, DC from March 1-3, 2010. The goal of the Summit was to attract our nation's best energy innovators from business, academia, and government to help begin building the next Industrial Revolution in clean energy technologies. The response was overwhelming. We had almost 1,700 registered participants spanning all stakeholder communities, many of which do not often come together. These include: scientists and engineers, entrepreneurs, small and large business CEOs and CTOs, technology investors from the venture community and investment banks, policy researchers and NGOs,. The technology showcase at the Summit displayed and provided demonstrations for the most novel and innovative energy technologies. We invited not only the technologies that ARPA-E funded in the first FOA round, but also those that we could not fund and gave those applicants the opportunity to showcase their technologies to other investors. We have been told that many financial deals were made.

The Summit also brought together as speakers and panelists an incredible lineup of energy thought leaders from around the country to address some of the most challenging issues and biggest opportunities for our nation. The highlight of these included Jeff Immelt, CEO of GE; John Doerr and Vinod Khosla from the venture investment community; Norm Augustine former Chairman and CEO of Lockheed Martin; Senators Alexander and Bingaman, and Congressman Gordon; as well as Secretary Chu. and senior leadership from DOE and the White House.

The Summit provided an opportunity for us to define ARPA-E as a catalyst for change which focuses on technological innovations that could produce potentially game-changing business opportunities. The Summit also provided a forum for the stakeholders to come together and engage regarding ways to innovate our future with fierce urgency. The initial feedback from Summit attendees has been very positive. Not only were people excited to learn about ARPA-E but also to see that ARPA-E enables and promotes a diverse innovation ecosystem to come together and interact. We are starting to plan the Summit of 2011 (with a much longer lead time), and we hope you will join us next year.

2011 Programs – Process and Potential Topics

The President's Fiscal Year 2011 budget request for ARPA-E includes $273.4 million for ARPA-E Projects. The ARPA-E Projects program provides funding and commercialization support to research and development programs at the intersection of applied sciences and integrated energy systems. ARPA-E has created a matrix-based organization structure. On one hand is the Applied Science and Technology Office or the "Technology Push" Office which will invest in platform technologies that can be integrated into various energy systems. On the other hand is the Integrated Energy Systems Office or "Technology Pull" Office, which will invest in the integration of these technologies into smart, energy efficient, and cost-effective energy systems that will have direct market impact. This matrix structure will maximize ARPA-E's resources and prevent organizational stove piping that could hinder innovation and stifle creative problem solving. See Fig. 3.

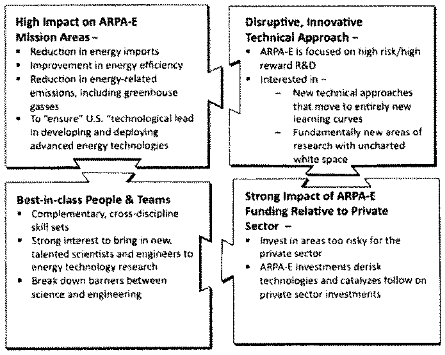
The planned program topic areas are (see Fig. 3)

- Decision Science/Buildings;
- Materials/Industrial Power;
- Thermal/Industrial Power;
- Information Science/Transmission;
- Materials/Renewables;
- Biological Chemical/Renewables;
- Thermal/Water & Agriculture; and
- Biological Chemical /Water & Agriculture.

To define the specific role of ARPA-E within these program topic areas, we will hold technical workshops. The results of these workshops will allow us to hone in on the specific technologies that ARPA-E will focus on through FOAs. We plan to hold several workshops to hone in on the FOA topic that will be based on the (a) concept papers and applications received from the prior FOAs, (b) the input received from the Requests for Information (RFIs), (c) input received from the six workshops that we have already held, and (d) the outreach and coordination with DOE applied and basic science offices. These workshops will provide community input about the current state of the art and technical stretch goals the community can possibly achieve in the next two to three years. The workshops also enable people from diverse disciplines to come together and promote teaming.

It should be noted that the output of the workshops could in some cases lead to multiple FOAs if there are distinct technologies that need ARPA-E's focus. Furthermore, ARPA-E may decide not to issue a FOA on some of these topics if it does not fit the ARPA-E mission.

In FY 2011 ARPA-E requests $35 million for the Materials/Industrial Power program topic area and $30 million for each other program topic area above. ARPA-E plansto invest in these areas for a maximum of three years. Each program will consist of multiple projects (between 10 to 15 projects) that will be selected based on the criteria shown in Figure 2. Within each program, the projects will pursue multiple technologies that either compete with each other to reach the same goals, or complement/leverage each other to form an ecosystem. In addition, ARPA-E requests $20.7 million for Seedlings, to provide funding for innovative projects that happen to fall outside the boundaries of the specific focus topic area FOAs.



High Impact on ARPA-E Mission Areas –

- Reduction in energy imports
- Improvement in energy efficiency
- Reduction in energy-related emissions, including greenhouse gasses
- To "ensure" U.S. "technological lead in developing and deploying advanced energy technologies

Disruptive, Innovative Technical Approach –

- ARPA-E is focused on high risk/high reward R&D
- Interested in –
  - New technical approaches that move to entirely new learning curves
  - Fundamentally new areas of research with uncharted white space

Best-in-class People & Teams

- Complementary, cross-discipline skill sets
- Strong interest to bring in new, talented scientists and engineers to energy technology research
- Break down barriers between science and engineering

Strong Impact of ARPA-E Funding Relative to Private Sector –

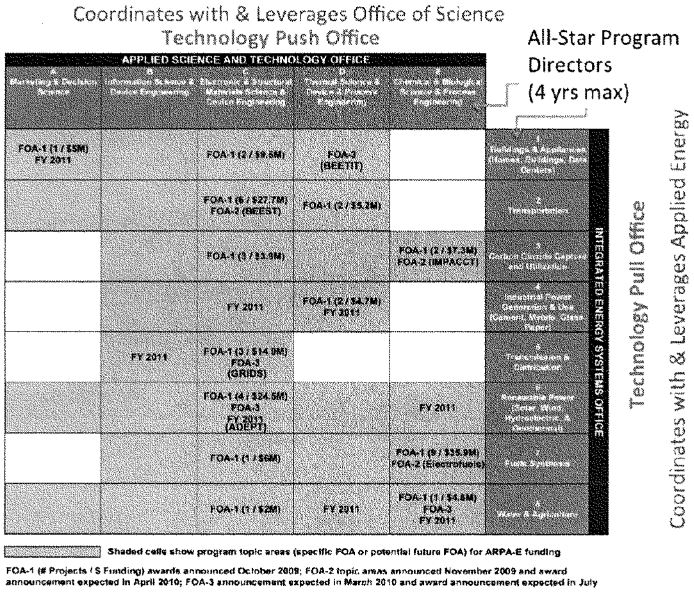
- Invest in areas too risky for the private sector
- ARPA-E investments derisk technologies and catalyzes follow on private sector investments

Figure 2 Selection criteria for projects.

Each project will be closely monitored by the respective program director. If a project is not meeting its potential, we may either help the team take a different direction to succeed, or terminate the project and reallocate the funding to those projects within that program that show promise.

Process of Program Creation: I would now like to explain the process of how we are creating ARPA-E technical programs. It is based on three basic principles:

1. Break down stovepipes between disciplines and remove artificial barriers between basic and applied R&D;
2. Encourage debate and partnership between technology pushers and pullers who will coordinate and leverage other parts of DOE; and
3. Provide thought leadership to create new programs.


Coordinates with & Leverages Office of Science
Technology Push Office

All-Star Program
Directors
(4 yrs max)

Technology Pull Office
Coordinates with & Leverages Applied Energy

APPLIED SCIENCE AND TECHNOLOGY OFFICE A Marketing & Decision Science	B Information Science & Device Engineering	C Electronic & Structural Materials Science & Device Engineering	D Thermal Science & Device & Process Engineering	E Chemical & Biological Science & Process Engineering	INTEGRATED ENERGY SYSTEMS OFFICE
FOA-1 (1 / $5M) FY 2011	▨	FOA-1 (2 / $9.5M)	FOA-3 (BEETIT)		1 Buildings & Appliances (Homes, Buildings, Data Centers)
▨	▨	FOA-1 (6 / $27.7M) FOA-2 (BEEST)	FOA-1 (2 / $5.2M)		2 Transportation
	▨	FOA-1 (3 / $3.9M)	▨	FOA-1 (2 / $7.3M) FOA-2 (IMPACCT)	3 Carbon Dioxide Capture and Utilization
	▨	FY 2011	FOA-1 (2 / $4.7M) FY 2011		4 Industrial Power Generation & Use (Cement, Metals, Glass, Paper)
	FY 2011	FOA-1 (3 / $14.9M) FOA-3 (GRIDS)			5 Transmission & Distribution
▨	▨	FOA-1 (4 / $24.5M) FOA-3 FY 2011 (ADEPT)	▨	FY 2011	6 Renewable Power (Solar, Wind, Hydroelectric, & Geothermal)
	▨	FOA-1 (1 / $6M)	▨	FOA-1 (9 / $35.9M) FOA-2 (Electrofuels)	7 Fuels Synthesis
▨	▨	FOA-1 (1 / $2M)	FY 2011	FOA-1 (1 / $4.8M) FOA-3 FY 2011	8 Water & Agriculture

▨ Shaded cells show program topic areas (specific FOA or potential future FOA) for ARPA-E funding

FOA-1 (# Projects / $ Funding) awards announced October 2009; FOA-2 topic areas announced November 2009 and award announcement expected in April 2010; FOA-3 announcement expected in March 2010 and award announcement expected in July

Figure 3. ARPA-E's Matrix Organization Structure that involves coordination and leveraging with other parts of DOE and program creation at the intersection of technology push and pull.

Figure 3 illustrates how these principles will continue to be executed through the following process:

1. Recruit the best and the brightest program directors from the technical community for a maximum of four years. These are people who have one foot in science and engineering, and the other in technology development and business.
2. The program directors will be involved in one of two offices – the technology push office and the technology pull office.

   a. The technology push office will coordinate and leverage the DOE Office of Science and the whole scientific community to identify discoveries and inventions in science that could transform the energy technology landscape via new devices and processes
   b. The technology pull office will coordinate with and leverage the DOE Applied Energy Offices (Energy Efficiency and Renewable Energy. Fossil Energy, Nuclear Energy, Office of Electricity, and Office of Environmental Management) as well as small/large industry and venture capital community to identify technology and market gaps.
3. Based on push and pull knowledge, workshops are held to bring multiple communities together to identify technical challenges and opportunities that connect science to technology and markets
4. Based on the community input, the program director will propose a new program within ARPA-E at the intersection of technology push and pull that addresses both science and markets. As part of this proposal, the program director will answer a set of questions on ARPA-E program criteria (see below). There will be an internal debate that will involve all the other ARPA-E program directors, me, and other relevant program managers within the DOE.
5. After feedback from other program directors within ARPA-E as well as other offices within DOE, a new program will be created.

Program Criteria: The 10 questions that each program director has to address to create an ARPA-E program are:

1. What is the global landscape of the field – science, technology, markets, players?
2. What are the major gaps and "white spaces"? Have you coordinated with the rest of DOE?
3. What's new and why is it a potential game-changer?
4. Is there room for left-field ideas? Can your goal be reframed to achieve a better outcome?
5. If successful, what potential impact can it make in terms of quantitative metrics?
   a. *Energy independence & security*
   b. *Reduction of GHG emissions*
   c. *Technological lead for US*
6. Who will adopt this technology? Who are the customers?
7. Will it scale in cost and volume? What instruments (financial, policy, etc.) do you need downstream for scaling? Are there non-technical barriers (policy, markets)?
8. Who are the potential teams and players?
9. What is your potential risk profile and time horizon – low, medium, high, short/long-term?
10. How much will it cost and why?

Where the first FOA was open to all technologies, the programs in the second FOA round (BEEST, IMPACCT, and Electrofuels) and the third FOA round (GRIDS, BEETIT, and ADEPT) were successfully created via such a process. Each program will go through three screening or review process steps to identify projects that can be funded – a five-page concept paper stage that will involve an external review panel, a full application stage that will also involve a second and different review panel, and finally an internal vetting process involving the program director and the ARPA-E Director. The concept papers and full applications are reviewed by a panel of reviewers that consist of distinguished members of the technical community as well as technical leaders within DOE.

Coordination within DOE and other Stakeholders

The coordination and leveraging within DOE is an important issue for ARPA-E. To enable this, we have created the Panel of Senior Technical Advisors, or PASTA. The members of PASTA are a group of technical leaders within DOE spanning the Office of Science, Fossil Energy, Nuclear Energy, Energy

Efficiency and Renewable Energy, and many others. PASTA will meet at least twice a year to discuss the following items:

1. What programs ARPA-E is running;
2. Some results from these programs that may have impact on other parts of DOE;
3. Interesting proposals and ideas that we could not fund that may be relevant for other parts of DOE;
4. Plans for recruiting, technical workshops, and future programs;
5. Scientific and technical gaps and challenges that we have encountered;
6. Any breakthroughs from other offices of DOE that are relevant to ARPA-E; and
7. Coordination between Energy Frontier Research Centers (EFRC), Energy Innovation Hubs (Hubs), and ARPA-E.

It is important to point out the differences and coordination between EFRCs, Hubs, and ARPA-E:

- EFRCs focus on small teams exploring basic science issues.
- Hubs will ideally be located under one roof and will bring together a diverse team of researchers spanning basic and applied. Their work will have a common goal, but will require addressing multiple challenges in a coordinated and focused way. The Hubs are modeled after the Office of Science Bioenergy Research Centers.
- ARPA-E is modeled after DARPA, i.e. it will invest in high-risk/high-payoff time-bound projects focused on combining various science and engineering discoveries and inventions into energy technologies with potentially commercial impact.

The feedback loop, coordination and leveraging between EFRCs, Hubs and ARPA-E is critical. The scientific discoveries and inventions made in EFRCs and Hubs could lead to ARPA-E technologies with significant commercial impact. A historical example of this is the invention of the transistor leading to integrated circuits – this translation required both science and engineering of devices and manufacturing. Furthermore, it is important to note that during this translation, one may encounter major technical barriers, which will require going back to science to solve them. Hence, EFRCs and Hubs could leverage off of ARPA-E as well. As mentioned above, the Hubs are designed to ideally be located under one roof. However, if the Hub encounters a technical challenge that the Hub team cannot address, ARPA-E could engage teams from the rest of the nation to help address the challenge and enable the Hub to make progress.

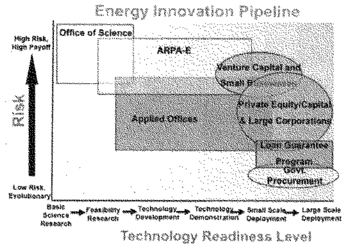


Figure 4 Energy innovation pipeline

In addition to technical coordination, it is important for ARPA-E to coordinate with other stakeholders. Figure 4 (above) shows a chart of the energy innovation pipeline that highlights the high-risk focus of ARPA-E and its interaction with DOE's Office of Science on the one hand and DOE's Applied Offices and the investment community on the other.

Final Comments

I recognize that these early days are a very critical period for ARPA-E. We are currently putting together our DNA and we must get this right by innovating in our internal processes. We have a new organizational structure that is not only nimble and agile, but one that breaks down potential silos between various disciplines and encourages internal debate and discussion within the program in addition to coordination with the rest of DOE. I am also delighted to report that we have been able to recruit some of the best and the brightest from the technical community as program directors for a maximum of four years. We have also created the ARPA-E Fellows Program to recruit some of best young minds to join ARPA-E for a maximum of two years and help us craft new programs by identifying technological opportunities in the global energy landscape.

From my past experience in the R&D community, and through what I have now seen in ARPA-E, I can assure you that the innovation process is in full swing in the US. Energy is now receiving the attention of the best minds in our country and is attracting new talent. I am confident in saying that we are not limited by a lack of ideas. We still have the best R&D infrastructure in the world, and a thriving innovation ecosystem in business and entrepreneurship. I am very optimistic about our nation's future. I pledge to use all my knowledge, expertise, and experience to continue growing ARPA-E into a robust engine of American innovation in energy and environment.

Mr. PASTOR. As I start my round of questions, I want to tell you that first of all, I believe that America needs to keep its edge, and I stated in my statement that that edge is probably now decreasing, but we need to maintain the edge.

Obviously last year's budget supported this administration and Secretary Chu. So that was proven by our budget, and it was passed last fall and many of the initiatives that he wanted were funded, and so we are here today, and the bill became law, what, about 6 months ago, more or less. So we have about 6 months under our belt, and we are now talking about the next fiscal year of 2011.

And it is my understanding that one of the hubs, and I think the one for which you have some direct responsibility, is fuels from sunlight. Now we are 6 months into the implementation of that.

So I am asking these questions because I am concerned, as we stated last year, that we didn't want redundancy and we are following the President's lead that we are in times of fiscal constraint, so we are following that, and so we want to make sure that this subcommittee, in looking at your budget, makes sure that the money is well invested and it meets the needs of our country and at the same time keeps the edge that we have in science. The questions I want to ask you are under that premise.

I am going to start with the hub. As I recall, when we were told about the hub, the hub was a model that was going to be taken from the lab, the Bell Labs, wasn't it, where you had one site and you had all these scientists, engineers, mathematicians, all the intelligence. We are then going to go from basic science to continued research and then the final implementation other than all this work in the lab. People would be able to look at what was being done in basic research, and if it couldn't be implemented you say time out, no, no, hey, start all over.

One of the criticisms that we heard was sometimes we have these labs on a particular project. And even though they may not work at the end, they continue to fund them because you give people jobs and the scientists who were working on it, you know, need to continue working. We give grants to universities and the person making the research will continue to say we are about to get to where we want to be, but fund me one more time and we are getting there. And so we said, well, this is an idea that is probably ripe and so here we are.

So I am going to start, basically, with the hub, and then I am going to ask you how grants that are being given this year and in the past, the ARPA–E money, where it has gone, the frontier, where the national labs has fallen.

So I will start with the fuels for sunlight hub. What is the objective of that hub? And if you could keep your answer down to five minutes, I would appreciate it.

Mr. BRINKMAN. Either us of us can answer that.

Mr. KOONIN. Energy comes in several different forms. We have got sunlight, which is good for warming things up.

Mr. PASTOR. I am personally from Arizona, I know all the benefits, I know about sunlight. Look at this tan.

Mr. KOONIN. I spent most of my time in London, so I didn't see the sun.

Mr. PASTOR. I know about sunlight. I understand.

Mr. KOONIN. And we can turn sunlight into electricity pretty easily.

Mr. PASTOR. Well, not that easy but we can.

Mr. KOONIN. We hope to do it better.

Mr. PASTOR. Not as cheap. Okay.

Mr. KOONIN. However, at the moment. Electricity is not the best way to power transportation, and chemical energy is, for the next several decades, probably the best way to power transportation. And so it would be wonderful if we have a direct way of turning solar energy directly into chemicals.

Plants, of course, do that, but then we have to go through another step, fermentation and so on, if we can get the essence of photosynthesis and do it artificially, more rapidly than nature does it, that is the goal of the hub, to turn solar energy into chemical——

Mr. PASTOR. So solar energy will come out to some sort of fuel that you could use to run a car, run a truck, run a plane, whatever it might be?

Mr. KOONIN. Exactly.

Mr. PASTOR. Okay. So that is the objective, what is the status of it?

Mr. BRINKMAN. Let's see, the status is that we are in the process of collecting proposals of everyone in the next couple of weeks, we are closing that out, we will then go through an extensive review process of the possible proposals, and we should have that all done by June and announce a first award, the B award of the—that is the schedule we are on. We are getting a lot of proposals, frankly.

Mr. PASTOR. Sure, I hope so, that was the intent. For 25 million we would hope you would get a lot of proposals.

Mr. BRINKMAN. Yes we are getting a lot of proposals.

Mr. PASTOR. So June you would have the award to whatever consortium is elected.

Mr. BRINKMAN. That is right.

Mr. PASTOR. Okay. We have given ARPA money or ARPA–E money, we have been funding frontiers, I guess, since 2009. And then we funded how many last year?

Mr. BRINKMAN. We funded a total of 46 Energy Frontier Research Centers. They were funded from the ARA money.

Mr. PASTOR. We have the national labs.

Mr. BRINKMAN. Well, let's see, I think 30 some of those—

Mr. PASTOR. Well, but we also do research at national labs.

Mr. BRINKMAN. Yes, yes.

Mr. PASTOR. And then we have other grants that probably do not fall under these categories.

Mr. BRINKMAN. Right.

Mr. PASTOR. So what I would like you to explain to me, and you can go, I heard that the ARPA–E, that some of the awardees received money and may be a private sector and a combination of public-private that would transform CO_2 to fuels. I thought I heard that testimony.

Mr. MAJUMDAR. That is right.

Mr. PASTOR. And since CO_2 is one of the products, you know, it is part of photosynthesis—so the question is this, was this grant given in relationship to this hub? Is this going to be working with the hub, what are the inner links to the hub or are these guys going to be lone warriors out there doing their own thing and hopefully it will work itself into the hub?

Mr. MAJUMDAR. The idea of the ARPA–E is to take the science that our Office of Science is developing and discoveries and see how you can mix and match and address a market need.

Mr. PASTOR. Okay. Well, in this case the market need is to get fuels from sunlight.

Mr. MAJUMDAR. That is right, but it need not—so our program on electrofuels, I think maybe that is what you are referring to.

Mr. PASTOR. You said transportation fuels from CO_2. Wouldn't this fall within the hub?

Mr. MAJUMDAR. No.

Mr. PASTOR. Why not?

Mr. MAJUMDAR. It need not be sunlight.

Mr. PASTOR. Oh, okay.

Mr. MAJUMDAR. So it is different. So you have electricity coming out of wind. And the question is can wind energy be converted to fuels, so that is electricity, carbon dioxide and hydrogen, and you have got a lot of hydrogen, for example, in natural gas. It is very hard to store hydrogen.

Mr. PASTOR. No, I understand. That is why you want your battery hub.

Mr. MAJUMDAR. But to store hydrogen, the best way to store hydrogen is hydrocarbon, which is gasoline.

Mr. PASTOR. Right, but let me ask the question this way because I don't want to take too much of your time. What grants do you anticipate after June and in the fiscal year 2011 from ARPA–E that will directly affect or be involved or integrated to this hub of fuels from sunlight?

Mr. MAJUMDAR. Right, so one of the things, let me just make it very clear.

Mr. PASTOR. Okay. Thank you for making it very clear. It has been very unclear up to this point.

Mr. MAJUMDAR. If the hub is doing a particular R&D area, okay, we will complement that. That is, the hub is ideally located, supposed to be located in one location and under one roof.

So if they come across a barrier, let's say they are going along research and they come across a technical barrier that that team cannot address, because they don't have the teams, ARPA–E can engage the rest of the Nation in small teams to address that barrier and get the hub moving. So that is one approach.

Mr. PASTOR. But wasn't the intent, maybe I was wrong, but I heard that the hub was going to have the team that was going to be able to go from here to here to here to here and working together so that they would be in one site.

Mr. MAJUMDAR. One site, that is right.

Mr. PASTOR. And so now you have monies going out to an independent agent out here.

So tell me where their redundancy is out there.

Mr. BRINKMAN. Can I say something.

Mr. PASTOR. Well, let him finish. I am asking him.

Mr. MAJUMDAR. There are two ways, one is obvious, let's say in Arizona, for example, a state program.

Mr. FRELINGHUYSEN. Good choice.

Mr. PASTOR. We will see you in June.

Mr. MAJUMDAR. That is where I started my academic career is Arizona State.

Mr. PASTOR. Congratulations.

Mr. MAJUMDAR. So let's say the hub is one location and that is where the scientists and engineers are working together. But they come across a barrier that requires talent from the rest of the Nation. ARPA–E can provide, look at the barrier and provide teams from Pennsylvania, from New Jersey, et cetera. They say, okay, let's focus on this problem and address that problem. That is one.

The other way is if the hub makes a discovery that is going towards, you know, sunlight to fuels, but that discovery has implication of other things, we could look at that and say this is very interesting, this could have a market impact on some other field and ARPA–E could leverage that and address the market need. So those are the two ways that we can synergize and leverage earmark other and create some feedback.

Mr. BRINKMAN. Could I add something?

Mr. PASTOR. Sure.

Mr. BRINKMAN. You have to understand something like fuels from the sun support a very broad subject area.

Mr. PASTOR. Oh, I understand.

Mr. BRINKMAN. And we have, you know, the biofuels centers and they are very much like hubs. There are actually three of them, and these three have taken very different tactics or directions in trying to understand how to make biofuels from plant matter, cellulosic ethanol, et cetera. But they are very different if you go look at the three of them.

So the idea that having created a hub will have created something that covers the field is not something that is going to happen. It is a field that there are too many other things. The hub will undoubtedly find something that it will focus on and the whole idea is to get it focused and move quickly. You know, the bio comparison is you usually give a block grant to a university and the university faculty get together to divvy up the money, and then you hear back from them at the end of the whole, of the grant fund period.

Mr. PASTOR. That is what we wanted to avoid.

Mr. BRINKMAN. Yes, that is exactly what we are trying to avoid here. We are trying to create a dynamic situation in which people just, they are a research program as you go and that is I think a very exciting thing to do.

Mr. PASTOR. Well, it is very exciting, but at least this one person you are going to have to convince that—let me ask the question again, you have the frontier centers. Well, here is the question.

Mr. BRINKMAN. Yes.

Mr. PASTOR. What frontier centers will be supporting this hub or what frontier centers in their research, because they get money too, will add to or cooperate?

Mr. BRINKMAN. But there is only one or two that are related to the specific subject of the hub, you know, and they are small, much, much smaller, of course.

Mr. PASTOR. I understand, but that is money going out.

Mr. BRINKMAN. That is some money going out, that is right. The question is how much you are willing to spend on this particular field of science, and we are saying we are willing to spend a lot, because it is important.

Mr. PASTOR. See, that is a question we all have to answer here.

Mr. BRINKMAN. That is what we are trying to do. We are trying—I think in this case we have said hey, look, energy is our most important issue here today and we are trying to direct our scientific program to focus more on that subject. You know, we have—we are not focusing as hard on——

Mr. PASTOR. Why isn't it possible to bring some of these researchers that you have, to include them in the hub?

Mr. BRINKMAN. Oh, they will.

Mr. PASTOR. Show me how. How many do we have?

Mr. BRINKMAN. Well, the proposal will come in and it will certainly include some of these—the various proposals will include some of these researchers.

Mr. PASTOR. Well, let me ask the question this way, in 2011, you are going to have further frontier centers funded.

Mr. BRINKMAN. A few.

Mr. PASTOR. How many will be related to or involved in this hub or other hubs?

Mr. BRINKMAN. None.

Mr. PASTOR. Why not?

Mr. BRINKMAN. Because the new hubs the new EFRCs that we want to create are in subject areas that we do not currently fund, and we have kind of been selective. There have been things like materials growth, which is an area in which this country is falling badly behind, very much a research area.

Mr. PASTOR. Materials growth in what sense?

Mr. BRINKMAN. In the sense of growing single crystals and new single types of crystals and materials.

Mr. PASTOR. But don't you have some of that work going on in labs also?

Mr. BRINKMAN. Not so much. It is very interesting. We could have a very long discussion of this. This used to be a Bell Labs thing.

Mr. PASTOR. Don't you have some of this research being done in some of the labs?

Mr. BRINKMAN. Sure, we have some of it going and EFRCs are also funded—funds things at the laboratory, right, not just the universities. So they are a mix of labs and universities. I think 31 out of 46 is headed by universities and the rest are headed by national laboratories.

Mr. KOONIN. Mr. Chairman.

Mr. PASTOR. Yes.

Mr. KOONIN. Maybe if I could take a crack at trying to draw the distinctions between these different funding modalities.

Mr. PASTOR. Sure.

Mr. KOONIN. The hubs are really meant to be a large scale sustained push on a strategic area that is deemed ripe for advancement and ultimately commercialization.

You mentioned several qualities of them, quite accurately. I would add two more that are important, the Secretary has discussed. One is significant sustained funding in order to allow a large coherent research program and to attract the very best people and putting the tactical management of the program in the hands of working scientists who are very close to what is going on and can initiate or terminate lines of inquiry in order to get to a large-scale strategic goal.

ARPA–E is a very different beast. As Dr. Majumdar mentioned, it is much more tactical, the grants are short-term, there will be many of them, and one will sow many seeds in the hope that a few will come up, largely through the private sector.

The EFRCs Dr. Brinkman mentioned are somewhat in the middle, smaller scale, much more focused than the hubs are on particular technical problems at the head end of the technology chain.

These are the differences between the modalities, we can see a need for each one of them as we look at how we go about trying to do energy innovation.

Mr. PASTOR. Well, I go back to my beginning, that we support this administration in its attempt to continue the leadership in science and do research. We also support the administration in saying we, at these times, have to make sure that the monies are spent wisely. And I would, I guess, get to the working knowledge and have a clearer understanding if there is a priority with this administration and how these different funding sources that you are asking us to increase, are going to be complementary to the goals—I know there are things that need continued research.

I am a person that believes in basic research, but obviously, we have to make choices and you have made some choices already last year, and I am just trying to see how, in the choices you have made, how we can go forward and ensure that the dollars we are investing in science, which we want to do and are doing, give the biggest return.

I think crystal research is very important, but in terms of the priorities that you have now given us, you know, where does it fall in the whole scheme of things.

Mr. FRELINGHUYSEN. You will probably be speaking on my time, Dr. Brinkman, and I will be happy to recognize you. I am glad Secretary Koonin sort of invoked the private sector here. I mean, virtually every academic institution around the Nation and all the good people at our DOE labs, no matter what the focus of that laboratory is, I talked off the record before the hearing, you know, the diaspora of Bell Laboratory people, you know, there may be some minuses for what happened to Bell labs but in reality, the world has benefited, hopefully not China and India, but the issue here, I think people tend to forget, is that Bell labs is no more.

And I sort of would like to know where the private sector is in this overall equation. It is not DOE, Inc., and maybe we cannot create Bell laboratories and Secretary Chu came out of that culture as did you, Dr. Brinkman, and a lot of people did.

And I am sort of wondering how, where the private sector here is. Are we doing things? DARPA is a model—or ARPA is after the military model, DARPA. Could you provide some clarity here.

Mr. KOONIN. Let me try and then I will turn it over to my colleague.

Mr. FRELINGHUYSEN. I don't mind, I understand you have got tens of thousands of people working at DOE labs doing remarkable research, but I am sort of wondering where the private sector is here.

Mr. KOONIN. Let me give you a personal anecdotal first, and then I will turn to the more general. I spent 5 years in BP before I came to the DOE as chief scientist and before that, I had spent 30 years in academia understanding very well the national lab system in this country.

When I came to BP, I understood that the right way to accelerate takeup in their sector, what they were doing, was to effectively establish a large-scale academic research operation, which we call the Energy Biosciences Institute, $35 million a year, looking very much like a hub.

Mr. FRELINGHUYSEN. It is under the BP umbrella.

Mr. KOONIN. BP is a private corporation.

Mr. FRELINGHUYSEN. Well, I had Exxon for a number of years in my neck of the woods.

Mr. KOONIN. We sited that at the University of California, Berkeley and the University of Illinois because that is where we could engage the very best academic researchers in a team focused, in that case, on biofuels. We need to be doing the same thing as we stand up the hubs, embracing private industry early on, but private industry is the only way that we will get things deployed in this country. That is how we do it after all.

And so unless they are in there on the research at the beginning, in the hubs, and in other efforts that we stand up, it is just not going to get a transition.

Mr. FRELINGHUYSEN. So give us some assurance that they are actually in there now. Dr. Brinkman.

Mr. BRINKMAN. You know, I am just thinking—did.

Mr. FRELINGHUYSEN. We want to know everything here. We hope that there is a private sector that is just as innovative.

Mr. BRINKMAN. I just came across this yesterday, an example in which our simulation techniques have been used to simulate trailer trucks, long, haul trailer trucks and to do the aerodynamic around the trailer truck to try to reduce——

Mr. FRELINGHUYSEN. When we say "we"——

Mr. BRINKMAN. We worked with a small company, and this company has worked with us, we have used our super computers to simulate their trucks. And we have actually been able to make a roughly 50 percent improvement in gas mileage.

Mr. FRELINGHUYSEN. Which is a nice way of saying, and I have visited a lot of your labs, and we had some recent pleas from labs for even greater capacity for super computers. So how would you continue?

Mr. BRINKMAN. Well, I mean, I think this is a very good example of us having some specialized capabilities, super computers, that had we worked with companies, this is actually a fairly small company, and that makes use of our talent and our capabilities to solve a real-world problem. It will have a big impact on that company.

And so we do need—in my opinion, we could do more on this, but this is a very important way of doing things, and we have a lot of examples in the computer, the simulation area, where we work with companies.

Mr. FRELINGHUYSEN. But is it fair to say, in a world of super computers, which last time I checked was, you know, it is either Cray or IBM; that you have the critical mass.

Mr. KOONIN. Oh, yes.

Mr. FRELINGHUYSEN. And to some extent whether we like it or not, those capabilities are not in private hands, although obviously a hell of a lot of innovation, ingenuity is in those hands.

Mr. BRINKMAN. We should say we run two different programs that allows anyone in the country to put in a proposal, for—one for our really big super computers called Insight, the other is Cynec which uses some of our not quite-so-big computers. And an enormous breadth of things are proposed and put into, run by those machines, from private industry from all kinds of places.

Mr. FRELINGHUYSEN. And they have time on those computers. That is the way it is done, sort of time sharing. I just want to make sure in the overall scheme of things that the private sector is, indeed, what we are trying to buttress here. I have got all this stimulus, and my question was to be how we have spent the stimulus money. I know we have got a lot of capital renovation on aging facilities.

Mr. KOONIN. Sure.

Mr. MAJUMDAR. Let me take a shot at that, just to give you a little bit of background about myself, before I joined DOE 4-1/2 months ago, I was a professor at UC Berkeley and associate lab director at Lawrence Livermore Lab, but given the fact that I was in Silicon Valley, I was an adviser to a couple of venture capital funds and on the board of advisers for startup companies, so that mix of private industry, as well as academia, national lab. So that is the experience I came out from.

I should say that in the first round of ARPA–E dollars that went out, 45 percent of that went to small business, and that is a testament to the fact that we are looking at private industry. So let me give you an example of how ARPA–E will operate. So right now we have——

Mr. FRELINGHUYSEN. As long as you don't get too big. One. The issues here——

Mr. MAJUMDAR. That is exactly right. So if I may, one of the calls for proposals that we have right now is in advanced batteries, okay, so we have set a target of, you know, leap-frogging over today's approaches in terms of energy density, cost, et cetera. And cost is in everything.

So what we find is that if you are going, and we are getting the proposals right now, there may be five or six different ways of getting to those targets, and those are very risk approaches where it is hard to get private investment like venture capital money to come in.

Mr. FRELINGHUYSEN. It is hard to get private investment and venture capital to come in this climate period.

Mr. MAJUMDAR. Exactly. So this is where ARPA–E can play a very important role in looking and taking the risk, reducing the technological risk and supporting four or five different competitive approaches, and maybe one of them could be business ready, we don't know which one right now. And then once after 3 years or 4 years, we find that once they are business ready, let the private sector take it up and invest in and scale it.

And we are very close to a commercialization team to keep in touch with not only the venture community, but as well as for, you know, large businesses as well as for government procurement. We are mapping out what is the commercialization strategy. I should also say that we have now recruited a tech transfer person in all of DOE, and we are working very closely with them.

Mr. FRELINGHUYSEN. Well, I think my time is up. But, if, as you answer other members, if there is a way to sort of give us an accounting as to where the recovery and reinvestment money has gone, I think that committee would benefit from some of that.

Mr. MAJUMDAR. We will certainly get back to you.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Davis.

Mr. DAVIS. Mr. Chairman, thank you and for the three individuals who are here today, thank you for being here and the testimony you have given. It is always an opportunity for someone who lives in rural Tennessee to engage with the scientific minds of the world. Growing up in small rural Fentress County, my mother would often take a hands full of beans, we called them Patrick's head beans that had been passed down for generations. It is a not hybrid and grows some of the best-tasting green beans. It was just a small amount when they plant those and had huge harvests.

So science today is like an agricultural garden, what we invest and what we plant will eventually produce great results for us. So I am pleased you are here today discussing. I kind of have a way of making things more simple than the huge complex questions that we deal with.

But in Oak Ridge, in the eastern part of my district, and at Arnold Air Force Base in the central part of the district, at Arnold Air Force Base, we have an EDC and we actually do research and we do testing for every plane that is flown in our military arsenal today.

So as I look at those, go in those tunnels and look at what we are doing, I realize that through experimentation, we make things safer; through research and through development, we make our life safer, and we certainly make transportation safer.

I realize that in this country, we have always been on the cutting edge. We have been the ones who sent the person to the Moon and brought them back. There is just so much that in this Nation, we are always the first to do, and then we find ourselves behind Japan with the Earth simulator, and all of a sudden they were able to go at the level of about 40 Teraflops, whatever that means, so we realized we were behind again as we did and saw Sputnik and we became frightened with that, and so we took a new challenge.

We now have the ability for a Petaflop, I am not sure what that is, but we are looking forward perhaps even going to an Exascale, and they tell me that is as fast as greased lightning, I mean, that just moves really quickly for us. The area of the unknown for us, we can reach that possibly with the computers that we have.

So I am excited about the future. I know that when we look at these computers, it would give us probably solutions to a new energy simulation systems, and it is unbelievable what we are doing in science, the S&S project there that we have, we have one target almost completed, and I will talk about that, a second target, because most of that target is now pretty much is taken up by the world in experimentation.

So the question I have to you is that as we look at this great asset we have in Oak Ridge, and looking ahead into the next decade, how do you plan to keep the U.S. lead, and specifically DOE's plans for energy system simulation with what we currently have in this Nation, and especially at Oak Ridge?

Mr. KOONIN. So, as I mentioned in my opening remarks, we see a great potential in applying what we currently have in computation and skills and experiment to try to bring it to energy systems. And right now the internal combustion engine looks particularly attractive to us as a first application. If we can make engines that are 30 to 50 percent more efficient than they are currently by using simulation as a tool to improve the design, we obviously need to engage private industry as we go about this, we are building a design tool for them after all.

But the national laboratories are so far ahead in what they can do in terms of computing, validating them, that we need to marry that expertise with the private sector demand and we hope to be doing that in the next year or two.

Mr. BRINKMAN. Well, this is the same thing, I just gave you an example a minute ago of a situation where we worked with a private small company to ensure that we use our computing too as far as we can.

We are working hard at the same time, as you say, trying to get to Exascale, trying to understand how to go there, it is not easy, and it is going to require some really innovative science and architectural computers and things like that. And so it is very exciting for us from a scientific point of view to think about how to do that.

But from a practical point of view it seems to me we are getting to the point where we can simulate bigger and bigger things, right, more complex things, and that is changing the world, you know, there are just areas which previously you couldn't predict, but now you can, and, you know, the plasma physics that goes into fusion is now predictable, whereas it wasn't 15 years ago.

So these things are very, very important, and I think that we really want to push on the whole simulation business and getting coupled into industry as a function of time.

Mr. DAVIS. As Members of Congress, we often get drummed between our constituencies so at the Arnold Engineering Center or at the Arnold Air Force Base, obviously where they do the testing they will actually put in a either a model or a part of it and they will actually do testing on that to see how it will operate with the speeds that we will be flying our planes. So their concern was that in this super computer in Oak Ridge may replace the Wind Tones, and we lose the 2,500 employees.

And so I am working for both sides and feeling like a rubber band being flipped between. Then my understanding is that we will really never, ever be void of actual hands on, of verifying what that computer tells us is going to happen.

Mr. BRINKMAN. That is right.

Mr. DAVIS. And that is why I think it is imperative that, using that as an example, I think that is why it is imperative that we realize that as we look at these new energy sources we are talking about, whether it is energy from the sun, we know that solar is a part of it, we know that biomass is. But if we put all of our eggs in one basket—and that is something Mother told me not to do either, carry two baskets because we may not have eggs in the morning if you drop one basket and break them all.

If we put all of eggs in one basket, as we seem to be doing in this Congress, instead of looking at, I am just saying some of us, instead of looking at all the sources of energy that we have that provides probably 90-some percent plus of our energy today, much of that being fossil fuels and carbon fuels, we need to be looking at cleaning those up some.

So my hope is that all this new science we have, that we can start using that to at least bridge us to the future when energy will come from solar perhaps or wind, enough to supply the industries of this Nation.

I think my time is about run out. I will yield back, Mr. Chairman, thank you.

Mr. PASTOR. Michael.

Mr. SIMPSON. Thank you, Mr. Chairman. And thank you all for being here today. I was originally going to ask you about spallation neutron sources, linac coherent light sources, attosecond research and gas hydrates, but I think the answer might take too long, and I probably wouldn't understand it, so we will submit those in writing.

I actually want to follow up on what the Chairman and ranking member were talking about. You know, originally when Dr. Chu came in, I heard from many people that brilliant individual, the concern was science guy, and that the labs and so forth would be so concerned with science that we would forget about, at some point in time, you have to apply science to actual reality and what you can do in the real world.

I am happy to say that the reports I get from the researchers at the INL and so forth, they are very excited about what is happening in the cooperation between the Office of Science and the National Labs and what is going on there and the potentials for research that they are looking at and stuff. But I wonder, and I have asked this question before in different settings, we are essentially taking over a lot of the research that used to be done by the private sector; Bell Labs and so forth, we are now doing it with the government.

There is one fundamental difference. And that is that Bell Labs and the private sector research had a bottom line. There was a reason they were doing something, and that they had to show a profit in the long run. Not necessarily true with government. And we have created—and my concern is we have created what has been called the valley of death between research and using something out in the field that eventually you have got to have a product that industry wants, can use and can sell.

What exactly, and I am not just saying with the Office of Science, but within DOE in general, what coordination do we have with the private sector to have their input into what they think is necessary, what they need in their field? I am thinking specifically in the nuclear area where we are talking about NGNP, modular reactors, these types of things; what is there within DOE that includes the end users, the people who are going to be producing the electricity, the people who are going to be using it, high energy heat and all that kind of stuff?

And I was glad to see that each of you mentioned during the hearing your background. Just to repeat them, Dr. Koonin you were Professor at the California Institute of Technology, and you were with BP for a number of years as the lead chief scientist there.

And Dr. Brinkman, you were a Research Physicist at the Physics Department of Princeton University. You worked at Bell Laboratories for a number of years, and also were at Sandia National Lab for a period of time.

And Dr. Majumdar, you were Associate Laboratory Director of Energy at Lawrence Livermore, and you were also in the private sector advising small start-up companies in Silicon Valley, right.

Mr. MAJUMDAR. Right.

Mr. SIMPSON. Where is the private sector in all of this? And how do we get them involved? And what should we establish so that we have a relationship between scientists, the DOE and the private sector?

Mr. MAJUMDAR. If I may just answer that. When we create programs, ARPA–E's goal is to look at science, see what is interesting out there and address a market need. So the interaction with the private sector is something that we take very, very seriously.

Mr. SIMPSON. Is there a formal organization to do that?

Mr. MAJUMDAR. We have a commercialization team, commercialization and adoption team.

Mr. SIMPSON. Who does that include?

Mr. MAJUMDAR. People from the venture capital community that we have brought in to ARPA–E who can look at the portfolio of technologies and see what can be business-ready and interact with the business world and see how they could be adopted over there.

So when we create programs, we actually have a workshop. We bring the community in. And that community includes the private sector. I mean, half of the people that show up are people from the private sector, people from buyers, procurement people.

So we had a workshop on buildings that we jointly did with the Energy Efficiency and Renewable Energy Office with people from GSA, people from the military, so who are procurement people, and people from the private industry like United Technologies, Honeywell, et cetera, to see where the state-of-the-art in their field is and what can be done to enable business and then scale it. Because I think one of the things that we are taking very seriously is that if we can get technologies to the level that the private sector can pick it up and scale, that is the best way we can scale.

Mr. SIMPSON. I think your model has probably come closer to involving the private sector than most models that I have seen or most things that have been done.

I look at, and this is probably a question for NE under secretary more than anyone else, but we are focused on small modular reactors in this budget. Is that something industry wants? Is that something industry will use. What is going to be the government's responsibility in developing these and the cost that the government can incur? What can we expect to have to appropriate as a committee? What can we expect industry to contribute to this overall effort?

The same with NGNP. I mean, that is the debate that is going on. For 8 years that I have sat on this committee, it is a chicken and egg; well, we want the industry to make a commitment and do this, or well, we want the government to do this. And nobody is talking. And that has been a concern of mine. And I don't say this as a criticism. I say this as a hump we have got to overcome.

Mr. KOONIN. So let me address the NA issue specifically first. There is an advisory committee NIAC, which consists of members of industry and academia who provide program advice to the NE management, and so there is an industry voice there. A good deal of the NE program is focused on the light water reactors right now, you know life extension. There is a hub that is being stood up associated with modeling simulation, particularly for light water reactors. So to say that it is only focused on SMRs or NGNP.

Mr. SIMPSON. Not only.

Mr. KOONIN. But we need to be looking a head or two of course also.

More generally, I would note that, yes, we need to have the voice of industry. But my experience in industry taught me that industry is a wonderful optimizer given the policy playing field. And if we want to have industry accelerate innovation, we need a stable and sensible policy environment so that they can make the investments on the decadal time scale that we need.

Mr. SIMPSON. I would agree with that fully. And that is one of the big problems we have got, is that we have 4-year administrations, a Secretary of Interior, or Energy, that lasts sometimes 2 years, sometimes even shorter than that. And every time somebody new comes in, the policy changes. And we are talking about technology that is meant to last 30 years or so, or develop over a 30-year period. And that is the biggest problem we have got.

Mr. KOONIN. If we get the policies right and consistent, everything else will follow.

Mr. SIMPSON. We had a policy that we were going to open Yucca Mountain, and all of a sudden, we decided we weren't going to open Yucca Mountain.

I mean, we just change policies every time we get a new administration, and I don't know what to do about it. I am not saying that a new administration doesn't have the right to put their footprint down on what they want to do. They absolutely have the right to do that. But how do we establish in the political environment that we currently have, where things turn over every couple of years, 4 years, or whatever, how do we establish research programs that are meant to last 30 years? That is a problem that we need to solve somehow, because if I am industry out there, there is no way I am going to invest in something when I think it is going to change in 3 years.

Mr. BRINKMAN. You want to be a little careful here, because it seems to me that, on the research side of things within the Department, we have had very long-term and in many ways consistent funding. I don't care, you can cite your favorite example. There are lots of them that have really existed for long term. I think the problem has more been going on the technology, and driving technology is where I think you would argue.

Mr. KOONIN. The take-up.

Mr. BRINKMAN. The take-up is where the politics keeps coming in and more so than in science. Now, science goes up and down in its funding to some extent, but I think it has not ever gone down so bad that it is really not so critical or anything like that.

Mr. SIMPSON. Well, my time is running out, but in closing, let me just say, we need to get the Department of Energy, industry, Members of Congress, together and talk about this. How are we going to solve this? What kind of framework are we going to put together that we can solve this?

Mr. PASTOR. Thank you.

Before I go to Congressman Israel, I guess I had some of the same frustration as some of us who have been on this committee. If you take Yucca Mountain for an example, we have been dealing with Yucca Mountain; I have been here for almost 15 years, and Yucca Mountain this and that. And then from one day to the next, a Blue Ribbon committee, okay, all right. What happens to all that money we spent to get there?

I can remember when, all of a sudden, the hydrogen fuel cell became the mantra. Hydrogen fuel cell, and all of a sudden here we are talking about millions of dollars here to this lab and this university and Israel's district. And here we come, a new administration, zero. And so we are looking at each other, and to his credit, obviously money had been invested. People had gotten involved. The private sector, I had a conversation with 3M. 3M had started a small division to start dealing with the hydrogen fuel cell. All of a sudden, guess what? You had a number of scientists, and what is next?

And I think that some of the questioning today is, you know, because we have hubs and all these new initiatives. And I agree that the basic science is basic science, and you need to do it, but again, we need to spend the money wisely. I am taking his time, so let me go ahead. And then you can respond when I get back.

Mr. BRINKMAN. Respond on his time.

Mr. PASTOR. No, you can respond to me.

Mr. BRINKMAN. I see. Okay.

Mr. PASTOR. Go ahead.

Mr. ISRAEL. For the record, the only hydrogen I have in my district is the Long Island Sound and the Atlantic Ocean.

Look, I can barely operate a TiVo, so I would never believe that I as a Member of Congress should be the one to decide what science works and what technology is the next great solution. I believe our job is to incentivize all the sciences, to be agnostic, to let the sciences compete against one another, to commercialize those sciences where it is viable and then have the marketplace compete and decide who the winners are and who the losers are.

One of the things that I am concerned about is, I view research and development as a tool to retain our global competitiveness. We are frustrated, all of us on this panel, when we read stories about how China is now ahead of us in clean technology, how we are losing to Germany and Spain on solar, how we are losing to Brazil on biofuels, how we are now losing to Israel on electric vehicles. They are going to make gas stations obsolete. They are going to make the internal combustion engine obsolete by deploying a whole new fleet of electric vehicles. But the response to that, the good news, I think, is in most of the 37,000 applications that you got in your first solicitation——

Mr. MAJUMDAR. 3,700.

Mr. ISRAEL. I am sorry, 3,700. Was it 3,700 that you received on your first solicitation?

Mr. MAJUMDAR. That is right.

Mr. ISRAEL. Okay, 3,700. Now, some of them defied the laws of physics and defied the laws of gravity, but most of them, most of them tell you that there are entrepreneurs in this country who are ready to lead us to the next generation of solutions.

My colleague Mr. Davis talked about landing men on the moon in a decade. It started in a garage that was owned by Leroy Grumman on Long Island. That is where that technology began, not in NASA, not in the government, but in the private sector in somebody's garage, in a small mom-and-pop operation that didn't have enough capital to rent office space, so they ran it out of their garage.

One of the things that I think that you did very well, for those companies that you couldn't fund, you responded to Bart Gordon's suggestion that you find ways to showcase them. You were only able to fund 30-plus of the 3,700. But as Chairman Gordon pointed out to you, there are some applications that really deserve funding; you couldn't fund them. You don't want to just close the door on them. You need to showcase them, and you need to accelerate those technologies. And so you did your ARPA–E Energy Innovation Summit.

And Dr. Majumdar, you talk about the fact that you invited not only the technologies that ARPA–E funded in the first FOA round, but also those that you could not fund and gave those applicants the opportunity to showcase their technologies to other investors, and we have been told that many financial deals were made. And so my question is, are you going to do future showcases? Do you have plans for additional innovation summits? And how are you going to proceed on that?

Mr. MAJUMDAR. Absolutely. I think, from all the feedback that we have gotten, these are anecdotal. Everyone felt that there was a new sense of energy in this ecosystem that is coming together. And I ended the conference by saying that what DOE and what ARPA–E, with its modest budget and people, what we can do is act as a catalyst and to bring people together and have them interact in ways that we cannot predict. And what we saw happen were financial deals were made, experienced CEOs educating the inexperienced CEOs what to do and what not to do. And that I believe, and the technology showcase, where we showcased all of the things that we could not fund, where all kinds of cross interactions were happening, which I think is a wonderful thing, and some people call it the Woodstock of energy innovation. And that is what we saw.

Mr. ISRAEL. Without Jimi Hendrix. Dr. Chu instead of Jimi Hendrix. A big difference.

Mr. MAJUMDAR. So I believe this is a good start. We have to keep it up; 1,700 people showed up on 2 months notice. And I think if you give longer lead time, a lot more will come, and the word will spread.

Mr. ISRAEL. Will you do additional summits?

Mr. MAJUMDAR. Absolutely. We are going to do summits every year.

Mr. ISRAEL. One every year?

Mr. MAJUMDAR. Yeah.

Mr. ISRAEL. And will you always do it in Washington, or will you consider plans to have the summits in different areas of the country where you have a technological capital?

Mr. MAJUMDAR. Well, I think that is a great idea. As of now, we have planned to do it in Washington, but we are flexible.

Mr. ISRAEL. Well, I would suggest that, given the fact that you had 3,700 applications and not everybody can afford to fly to Washington and take a hotel here, I think it would be very empowering for those companies, for you to bring those summits to them, to those communities, do one in Silicon Valley and New York. Make sure you do one in Pastor's district, very important.

Mr. MAJUMDAR. Thank you. Thank you for the suggestion. Great idea.

Mr. PASTOR. Well, since you were in Arizona, you know that the resort rates right now, because of the economy, you can get quite a deal, so then they will criticize you for going to a resort. That is the other side.

You wanted to say something, Dr. Brinkman. I didn't mean to cut you off.

Mr. BRINKMAN. I was going to say a couple of things about the private sector. And one of the things I should remind people, when they talk about the success of the laboratories, Bell Laboratories was unique for a reason which people tend to forget. And that is, AT&T was guaranteed a 12 percent return on its money. And that was the base of its expenses, so we were an expense. And so there was a steadiness of the funding that was a remarkable thing for many, many years. And that is what to me is one of the important things, is the fact that it was such a steady funding base, and it makes a huge difference having that.

Mr. FRELINGHUYSEN. If you would yield, it was actually the repeal of the Communications Act of 1934 that sort of broke the back of one of the greatest, world's greatest assets.

Mr. PASTOR. I was going to say, more competition, lesser rates. Are we down to about three hardline companies and cellular got invented?

Again, and so I thought I heard you say that ARPA–E is going out for a bid on storage, the storage capacity or new storage containers, et cetera.

Mr. MAJUMDAR. Batteries.

Mr. PASTOR. Batteries. So that is currently under way.

Mr. MAJUMDAR. Yes. We are receiving proposals right now, and that is batteries.

Mr. PASTOR. And I don't know what the investment is going to be. But again, getting back to where we are in the scheme of things, the office of electricity is also asking for money in their budget on this. And I am positive that you will have some frontier centers that are going to, again, ask for money for this, and so here you go again. There is the request for a new hub.

Hopefully, this bill will get done, hopefully this bill may get done in October, this fall. But you would have given out that RFP. Research would have started. Possibly some of these frontiers would have already started their research, and at best, this hub would be a year from now, at best, and that is at best. And that is still probably the RFP going out, and so, again, I would ask the question, because is it better now to wait until the results of your efforts, and then see whether or not we need to spend an additional $25 million on another effort. That is the question that we have.

And again, because we know money is scarce, we know that you need to fund various programs because they are equally as important, and so that is where we come up here and say, you are going on with this effort and you are going to be almost a year to 6 months ahead, where are we going to want to spend the other $25 million? And so this is a dilemma that I guess at least this person faces up here, and your clarification would be very helpful.

Mr. KOONIN. So let me try. You know, when you think about a battery, whether for grid storage or transportation storage, it is actually a pretty complicated physical system. You got the electrolyte in the middle. You got electrodes, and the interfaces between these materials are where all the action is really. We have developed great capabilities to measure such interfaces, perhaps even construct them, I mean, basic science. And those capabilities are really in the labs and the universities and not at all in the small start-ups or the private sector. So the hub, at least initially, my guess is, I don't know what the proposals will look like, but will be focused on that really fundamental problem. And that is there and will be there for a decade.

Mr. PASTOR. Could I just interrupt? I am sorry. But that has been what we have been doing in funding, and you will be doing in your funding. So what I am saying is, we are funding now to that question; how do we increase the capacity of a battery, whether it be for a car, a truck for transportation, or whether it be to store the wind energy that is being produced by wind energy? In stimulus money, I can tell you because I know, almost $85 million was given to a company in downtown Phoenix, and that is the private sector. And so I am saying, a year from now, we are talking about a hub, and we have in the past, been moving ahead. I know most of the technology and research is in Korea and Japan, so we have to catch up on that. Our battery business has pretty much gone overseas. So I understand all of this, but help me in seeing how the coordination and integration is involved.

Mr. KOONIN. There is a whole chain here, right? There is the basic research. There is the development, the packaging and then ultimately the deployment. Our batteries right now are frankly not good enough either, for transportation to be economical. We are a factor of five away in cost from what would make a battery electric vehicle general purpose useful. We are probably about a factor or two away in cost from what a plug-in hybrid would require. So there is a lot of research and development to do if we are going to make those applications possible.

The grid storage right now, large-scale grid storage, batteries are much, much too expensive, and we need to get down. Right now the cheapest way to store electricity is to pump water, pump it up, pump it down, by factors of 10 to 15. If we ever want batteries to be a player in that game, we need a lot of basic research and then applied development.

Mr. BRINKMAN. One other comment I might make, and that is, if you really look at our total effort in batteries, even including the hub, if we include that, we are not spending nearly as much as the Chinese, for instance. We think they are spending about $100 million a year. We are probably spending, when you add the hub in, $75 million, $80 million a year. So even though you might think we are doing an enormous amount, relatively it is not all that big or out of line.

Mr. MAJUMDAR. May I take a shot at that.

If you look at a lithium ion battery today, we have 1 percent of the world market share, 1 percent, and it was invented in the United States.

Last year, 2009, the Fermi award, which is the highest DOE award, was given to the gentleman who invented it. And so it is ironic that we are in this state.

So when you look at, how do we approach this problem, think of a pipeline. On one end is basic research, and these are discoveries, understanding of how these electrochemical reactions actually work, and why it does not work. And what we are trying to do in ARPA–E is to take that understanding and leapfrog over today to really go over and make it disruptive. Because if you try to create today's lithium ion batteries, we may be facing a losing battle. So the question is, can we go over, and it need not be lithium ion in the future.

Mr. PASTOR. Well, then, I will argue this point. If that is the case, why don't I take the—or why doesn't the subcommittee take more money from the hub and invest it in you?

Mr. MAJUMDAR. But we need the basic science. Let me explain. There is a reason why we need the hub, is because most of the people who are trying to put together, so what ARPA–E is investing in is people who are hands-on, putting things together and making the next-generation battery. Most of them will not work.

Mr. FRELINGHUYSEN. Will the gentleman yield?

So you are saying that we produce in this country 1 percent of lithium batteries. I happen to have a producer in my congressional district that does some very interesting things with lithium batteries for NASA. And hell, what we are doing to undercut NASA ought to worry every one of us here in terms of national security, much less other issues. You are almost conceding that we have lost that battle, and we are going to go on to some other type of battery.

Mr. MAJUMDAR. I think we need a portfolio, if I may suggest.

Mr. FRELINGHUYSEN. But you have to concede we have already lost that marketplace. It is pretty difficult to regain it if indeed lithium batteries have some minuses to them as well, environmental minuses.

Mr. MAJUMDAR. Right.

Mr. FRELINGHUYSEN. So you would concede that that is pretty difficult to get that back here?

Mr. MAJUMDAR. I think getting the manufacturing of that back—I mean, 1 percent was pre-Recovery Act. I think a post-Recovery Act is anywhere about 15 percent of the market share. But coming back to the challenge, these teams are trying to go aggressively in the high-risk approach in trying to get the next-generation battery. You know, we hope a few of them are successful, but many of them may fail. But they have to try, because we don't know whether it is going to fail or not. But when they fail, they will need to go back to basic research to understand why they failed, learn quickly from that, and innovate again. So that feedback loop is extremely important. And that is where you need the basic research.

And what we try to do in ARPA–E is develop technology so that it becomes market-ready, and that coordination is what I was talking about. That coordination is extremely important, and that is what we plan to do, and we coordinate very closely.

Mr. KOONIN. Even a leaping frog needs a good platform to take off.

Mr. FRELINGHUYSEN. Okay. That may be the quote for the day.

Mr. PASTOR. Well, we are working on yours.

You wanted to say something, Dr. Brinkman. Go ahead.

Mr. BRINKMAN. I was just going to try to reiterate. Batteries are, they are a fairly mature technology, but there are still many things that can happen.

And one of the things you should understand is, in the last 10, 15 years, the simple capacitors have changed enormously. All of a sudden, you have a thing called an ultra capacitor which is a factor of 1,000 more energy being stored in the same volume. And so you really have to be careful. And science does change things and changes the dynamics of things. And what we have today may not be the thing we have tomorrow. We have got to work on that. If you punt and say, hey, we are satisfied with where we are, things won't happen, right?

Mr. FRELINGHUYSEN. I serve on the Defense Subcommittee on Appropriations, and I often ask the four-stars that come in to see us, what keeps you awake at night? You know, we have cyber issues, systems being attacked right and left. I alluded to some of the things why it is important to support some of the good things NASA does. We need the ability to still launch things for space asset purposes.

We commented earlier a little bit on the New York Times headline this morning, “China Drawing High Tech Research From U.S.” You could well substitute India. But there seems to be a dynamic here somewhat explained in that article, which seems to be a little more disturbing than some of the other articles. This isn't just a question of outsourcing. This is actually a move of some of, I assume, highly-qualified scientists to China and setting up laboratories, which given the fairly robust Chinese economy, the quality of their workforce, the quality of their educational system, their dedication to going to school 6 and a half days a week, the number of scientists that they are graduating compared to us, the number of scientific papers, the number of patents. Hell, from what I hear from people we talked about before the meeting, hell, we are way, just on the patent submissions, we are way behind what is happening abroad. I just wonder what would be your message here? We need a wake-up call. Give it to us today.

Mr. PASTOR. Just a request, you need to turn on the mike, so we can get it for the recording, and people can hear you. Thank you.

Mr. KOONIN. You know, since I left my theoretical physics roots probably two decades ago, I have been increasingly co-student of socioeconomic technical trends. And what I have learned is it is hard to predict in detail, but there are some broad facts that really will likely determine the next several decades.

And I will just note one for you that causes me great concern. This country is 4.5 percent of the world's people and are about 23 percent of the world's GDP right now. So we are five times better off than the average citizen on the globe. And we have enjoyed that kind of out-of-whackness for two centuries, and we have benefited from it in many different ways. This country is wonderful and great and continues to attract great talent and do wonderful things.

But as you look forward, that 5-to-1 number is almost certainly going to change. And coming to grips with that, realizing the severity and likelihood of that problem and understanding what it means for the country's economy, technical lead, geopolitical heft and so on is something that we have not devoted enough time to, let alone figuring out what to do about it. That is what worries me most.

Mr. FRELINGHUYSEN. This is like Norm Augustine in "The Gathering Storm." That is exactly right. That is an aspect.

Mr. MAJUMDAR. We had an ARPA–E hearing in the end of January this year. And in my oral statement, I actually said, if there is any concern of mine, it is not the innovation. I think there are lots of innovators out here, brilliant people. The ideas that I am seeing, I am absolutely confident that we have the best ideas.

What keeps me awake at night is, how do we keep those ideas in scale in the United States? And actually I have a suggestion to make. And I don't know exactly how to go about doing it, but I would like to get your help in this. Is that the reason people are going to China, there are many reasons for it, but one big reason is there is a demand out there. There is infrastructure being created. Well, the government is the biggest purchaser of energy. So could we potentially use that to keep some of the innovations out here to use that to leapfrog, to pick those technologies which are the future and bring them into the market and stabilize it. And that is something that, you know, I am just proposing and just suggesting, but I would love to get your thoughts about that.

Mr. FRELINGHUYSEN. Well, it is interesting, and my time is up, there was an article, another article either in the Journal or New York Times the other day, about obviously the power of government contracting. And I don't mean to be political here, but there are some who suggest that the only people that will be allowed to step up to the plate would be those with unionized work forces. I mean, it is disturbing to me. I mean, if we want to recognize the history of our country, entrepreneurship, risk-taking, a lot of that comes from, as was described earlier, small innovators, mom-and-pop people working in their garage, former Westinghouse scholars in high school. We are on a trajectory here. If we use the power of our government contracting and define who is able and who is not able to participate, we are going to have some catastrophic results.

I am not asking you. It would probably be impolitic for you to react to my comment, but I find it disturbing that the power of that, the power of that ought to be focused somewhat, as you suggested, encouraging everybody, whatever their background and means, union and nonunion, to step up to the plate.

Mr. PASTOR. Mr. Davis.

Mr. DAVIS. As we discuss the concepts and ideas and the hope for new energy sources, including the storage battery, I think maybe we may be looking, we also ought to be looking at what uses that power source. For 2 and a half years, I have had a triple-A battery in this. Now, it is because the light bulb itself doesn't use much energy. I have an old pick-up truck. It is a 40-something model. And when I hit the starter on the floor, the battery has enough energy to crank that energy up, and then the engine is a combustion engine.

I wonder if we are doing enough work on what will be producing the power from that storage energy, the engine itself. Are we looking at that as being also an answer to this. When I look at the energy being produced by TVA, at our home, we cut the cost because we put in a 13-plus SEER electric heat pump. We put in fluorescent lights, and we have reduced dramatically because we are using appliances that will use less energy but still give us the same efficiency and actually keep the house as comfortable or refrigerator keep—I only heard about the battery itself, but are we not doing research on what will be using that to provide the power we need?

Mr. KOONIN. So the energy system really has two sides: The supply side, which is what you mention; and the demand side, how efficiently we use energy.

The Department has great programs and great leverage in controlling demand. We help set appliance standards, and we have been much more aggressive in promoting efficient appliances. We are looking at pricing mechanisms that would encourage more efficient use of energy. We are looking at technology development, as I mentioned, in automobile engines to make them more efficient at the same cost.

And then finally there are behavioral issues. If you just make the price of energy use evident to people. Without changing it, but just making it evident. So, for example, when you paid for gasoline at the pump, you also paid for your insurance and your road taxes, depreciation on your vehicle all rolled in together. That will start to change people's behavior. And so there are a number of mechanisms whereby you can think about reducing demand working on that side as well as of course working on the supply side as we have talked about.

Mr. DAVIS. See, I am concerned we are not doing enough in that area, because the gas tank of an automobile will be the new battery you are saying. But the engine up here, we have 4 cylinders and 8 cylinders. I mean, we reduce consumption by what will actually produce the power to pull that vehicle. I am concerned that we aren't doing them, because all I hear about is the battery.

Mr. BRINKMAN. Well, it is certainly not the only thing we are working on. I mean, earlier, I cited the fact that we worked with a small company doing simulations of the aerodynamic flow around trailer trucks. And that is a large part of the resistance to its motion. And we have actually been able to greatly increase the gas mileage of these kind of trucks. They have figured out how to break the turbulence off in the back of the truck and that kind of stuff.

Mr. DAVIS. That will work all over Tennessee and some Kentucky and some in Alabama as a general contractor. And I had a friend who is a mayor of a small town that, during the Carter administration, actually got a grant to look at maybe using, making synthetic gas from byproducts of wood. And they had a jet engine they were trying to fuel up. He grinned 1 day and said, we got it going one time. And they spent over $1 million doing that. Now, that has been 20-some years, and I think the grant has finally run out. Wherever it went, it went somewhere.

But that didn't work, at least not efficiently and at least not cost wise. And so I travel through my district, just outside of Marion County outside of Chattanooga, there is a huge it looks like almost space station out there. It is an old ethanol plant that never, ever produced. And there is a lot of money that is tied up in that. A lot of it was Federal dollars that was tied up in that. And what I don't want us to do, and I am all for science technology, but proven science is something I am for. But if we are just firing in the dark on some of these things, I have some problems with it.

Mr. KOONIN. So as you look at, as we look at energy technologies, whether demand side or supply side, I always use three metrics, three dimensions I try to think about them: One is scale. Can I imagine this getting big enough to have a significant impact? The second is cost. How does it compare to alternatives? And the third is timeliness. Do I have to wait 30 years for this thing, or is it ready pretty much now? And it is very interesting to rank energy technologies in those dimensions. You come to some pretty simple and compelling conclusions.

Mr. DAVIS. And I know we are doing that. I just want to say, as someone who is kind of a commonsense person, I get alarmed sometimes when I see success not occur when they should.

And I have another question, then you can answer both of those. At the SNS project, obviously in the mid-1990s, we decided that the Super Collider was not the best way to spend our dollars, so we went to the SNS project. We put that at the National Labs. Fortunately it is in Oak Ridge, and we are glad that it is there. We have the initial target pretty well finished. We are halfway through. Right now, almost all of those slots are pretty well taken up. I notice there is not any funding to start the second target. I hope we can do that soon, and what are the plans for that?

Mr. BRINKMAN. It is true, we have not started the second target station. It is really basically on our list, but it is, right now, not our highest priority thing. We are trying to finish NSLS II. We are trying to finish the 12 GeV machine in the Jefferson Lab. So we have a bunch of things in the pipeline right now that we have to get finished before we can attack that problem. We would love to do it but, hey, finite resources.

Mr. DAVIS. I look forward to working with you as we navigate through that.

Mr. Chairman, thank you. I think I used my time up. I yield back.

Mr. PASTOR. Mr. Simpson.

Mr. SIMPSON. Thank you. I will be brief.

Everybody here said they support sciences. I kind of agree with Mark Twain, progress is okay once, but it has gone on far too long.

I am just kidding. Sorry, Rodney.

I need to ask a quick question. Under Secretary Koonin, the fiscal year 2010 Defense Authorization Bill reduced the general plant project limit to $5 million for NNSA labs for 2011. This subcommittee has supported a $10 million GPP limit for labs to give them greater flexibility in construction of small buildings. Would you support us keeping the GPP limit at $10 million for nonNNSA labs?

Mr. KOONIN. I only know the science labs well. I think $10 million is about the right number as a limit. I can't speak for the NNSA side of the House, but for science, I would encourage you to look at $10 million.

Mr. SIMPSON. I appreciate that. Let me just say, in conclusion, about what I was talking about earlier, one of the prime examples that I use is that the last administration came in, and they had this proposal GNEP. The committee here didn't quite know what to do with this. There were aspects of it that we agreed with, there were aspects of it that industry agreed with. I mean you know they didn't agree with all of it because nonproliferation is not their issue and there were nonproliferation aspects of GNEP and stuff. And so we never really fully funded it or anything like that.

Then we have a new administration that comes in. They want to refocus all that, do hubs. The committee kind of looks at it like now. What is going to be the proposal 3 years from now? We don't know. And that is why you see kind of reluctance on this when they came in with eight hubs proposed originally and stuff, and we said, let's do a little bit and see how it works out. And that is kind of where we are right now. And that is why we want to see how these hubs are working and exactly what we are doing with them.

When I read your bios and stuff, I didn't want you to get the impression that I was trying to say you weren't qualified or anything. I think you are. That is something that you all have every right to be very proud of. And we are very lucky to have you working in the government. And I thank you for the work that you are doing and look forward to working with you to address these concerns that we have so that we move forward together. Thank you.

Mr. FRELINGHUYSEN. Echo Mr. Simpson's comments. I am sure the Chair does as well.

Secretary Koonin, I found in your opening statement, you made comments in I think support for inertial fusion energy. But looking at your budget request, the budget request is not commiserate with that. And I sort of just wonder, are you considering some sort of a shift here from supporting magnetic confinement?

Mr. KOONIN. No intention of a shift at all, but inertial fusion——

Mr. FRELINGHUYSEN. We have been pretty supportive here of obviously domestic fusion and ITER. And while there have been some problems along the road here, is there some sort of a shift going on here?

Mr. KOONIN. No. But there is a new player on the scene, if you like. You know, inertial fusion energy has been, or inertial fusion generally has been pursued by the NNSA for 20 years. And I have been actually glad to have helped out with that just about over that same course. We are now on the verge of passing a milestone where we may actually be able to get more energy out than we put in through ignition. We will know that, I think, within the next several years.

Mr. FRELINGHUYSEN. This is at the NIF.

Mr. KOONIN. This is at the NIF, that is correct. They are just about to start an ignition campaign later this year. If they are successful, that opens up a new route to fusion energy that we have not had before. That does not mean that we should deemphasize at all our commitment to magnetic or to ITER, but it does mean that we would be remiss if we didn't capitalize on that achievement and seriously look at and do a technology assessment for inertial fusion energy. It is another case where, if we don't, the Europeans are moving rapidly on this already, and they will. And so you could have a repeat of lithium ion batteries or solar cells and so on.

Mr. FRELINGHUYSEN. Thanks for providing that clarity. That is important. Again, thank you, for your appearance.

Thank you, Mr. Chairman.

Mr. PASTOR. Thank you very much for being with us this morning. You have your role to play in government. We have ours. But in the end, we are here for one purpose, and that is to serve the American public, so we are one team.

And we look forward to working with you, and we will submit some questions for the record. And if you could return the answers, we would greatly appreciate it. But I know that we will continue to work with you to get a budget that ensures that America keeps its lead in science and that the taxpayers are rewarded by your efforts. And we thank you very much. And we wish you a great day and thank you very much.

The hearing is concluded.

QUESTIONS FOR THE RECORD

ENERGY AND WATER DEVELOPMENT SUBCOMMITTEE
HOUSE COMMITTEE ON APPROPRIATIONS

DEPARTMENT OF ENERGY: OFFICE OF SCIENCE AND ADVANCED RESEARCH PROJECTS AGENCY – ENERGY

BUDGET HEARING

MARCH 18, 2010

WORLD LEADERSHIP ON PETAFLOP COMPUTING

Mr. Pastor: The Committee is pleased to have been able to fund modernization last year of the Jaguar computer at Oak Ridge National Laboratory, which then became the fastest computer in the world. But I wonder if such a distinction is more than an honorific.

Do you have any hard evidence that having the fastest computer actually recruits the best and brightest young talent?

Mr. Koonin: Of course, it is not just the fastest hardware, but the whole high performance computing environment that attracts the best people—how the machines are used and the problems to which they are applied. Oak Ridge National Laboratory has been recruiting world leading computational scientists and is today an internationally recognized center of excellence. In the first months after acceptance of the machine, the Leadership Computing Facility at Oak Ridge National Laboratory (OLCF) had at least three applications performing significant scientific calculations with sustained performance of over a petaflop. In both 2009 and 2008, ORNL teams won the prestigious Gordon Bell prize from the Association for Computing Machinery for world-record breaking sustained performance from a scientific application. The 2009 team, led by Marcus Eisenbach, achieved 1.84 thousand trillion calculations per second—1.84 petaflops—for an application that analyzes magnetic systems and, in particular, the effect of temperature on these systems. By accurately revealing the magnetic properties of specific materials, the project promises to accelerate the search for stronger, more stable magnets, contributing to advances such as lighter, stronger motors for electric vehicles. This project involved researchers from around the world. The 2008 team, led by Thomas Schulthess, achieved 1.35 petaflops for a simulation of superconductors, which are materials that conduct electricity without resistance.

Also, this facility attracts users from around the world who are given access to this machine through the Department's Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program. In the recent INCITE peer review panels, reviewers commented that the proposals represented some of the most cutting edge computational research in the field. For example, this year's INCITE awards include projects in combustion to increase efficiency and reduce emissions to develop safe and renewable energy solutions; in the environment to develop better insight of natural phenomena like earthquakes and hurricanes; in climate modeling to improve climate models, understand global warming, study the effects of turbulence in oceans; and in biology to increase understanding of protein membranes to improve drug discovery, diagnostics and better treatment of diseases.

COMPUTING UPGRADES AT OAK RIDGE NATIONAL LABORATORIES

Mr. Pastor: The Department received funding in fiscal year 2010 to perform upgrades to the Oak Ridge National Laboratory's (ORNL) advanced scientific computing facility. The budget request before us today includes additional funding to begin pilot projects at this facility on the journey towards exascale-speeds.

What work has been begun or completed on the Jaguar computer that increases its speed in the near-term? For the time being, where does that leave ORNL's advanced computing ability in relation to the rest of the world?

Mr. Koonin: Based upon past successes and future promise, high-performance computing is integral to the plans of almost every program element of the Department. Therefore, it is essential that we continue to push the frontiers of that capability.

The OLCF was upgraded to six-core chips and peak speeds of over two petaflops in 2009 with Recovery Act funds. This upgrade made OLCF the most powerful system in the world according to the November 2009 Top 500 list of the world's fastest supercomputers.

Mr. Pastor: Can you describe the pilot hybrid computing system at ORNL, what funding is included in the budget request for this purpose, and how close to an operational pilot system the funding in the budget request would bring us?

Mr. Koonin: The FY 2011 budget request includes $9 million in the OLCF budget to begin the acquisition of an operational prototype with hybrid architecture, a mix of standard processors and specialized processing engines such as a graphic processing unit, which offers higher performance at greater efficiency and computing power but also introduces new system and application programming challenges. This pilot system will be made available to the leadership computing community to begin porting their application codes to the experimental hybrid architecture.

COLLABORATION WITH THE NNSA ON ADVANCE SCIENTIFIC COMPUTING

Mr. Pastor: The Office of Science and the National Nuclear Security Administration (NNSA) each have an interest in the improvement of advanced computing systems. How is the Office of Science working with the NNSA for activities across the Advanced Scientific Computing program?

Mr. Brinkman: The computing organizations in the Office of Science and NNSA—Advanced Scientific Computing Research (ASCR) and Advanced Simulation and Computing (ASC), respectively—collaborate in a variety of ways. At the program level, the leadership meets at least quarterly to explore topics of mutual interest. Under the aegis of the Undersecretary for Science, those meetings have been monthly for the past 6 months as the programs jointly direct activities defining potential paths forward in the development of exascale computing. ASC co-funds Scientific Discovery through Advanced Computing (SciDAC) activities under the program run by ASCR. The programs co-funded follow-on R&D for the BlueGene family of supercomputers, which resulted in BlueGene/P machines coming to market and earning IBM the prestigious Presidential Technology Innovation Award. ASC and ASCR are committed to advancing U.S. science applications to provide them a competitive edge through parallel computing at the petascale and beyond. Less formally, Science and NNSA laboratories routinely collaborate. The most recent collaboration, the Hybrid Multicore Consortium, is jointly led by the Lawrence Berkley, Lawrence Livermore, and Oak Ridge National Laboratories and was motivated by delivery of the Roadrunner platform and projections of similar architectural features in future supercomputers.

SPENDING ON FACILITIES

Mr. Pastor: You are requesting a large increase in spending on facilities, up from the current $208 million to a requested $261 million. You've also been appropriated $125 million for facilities under the Recovery Act.

In light of the fact that Advanced Scientific Computing expansion to support present technology is approaching a hiatus while you work on the very extreme challenges of going to exascale, why are such large increases in facilities the best use of funding at this point?

Mr. Koonin: The FY 2011 facilities request of $261 million is an increase of $29 million from the FY 2010 appropriation of $230 million. Of this increase, $20 million is for lease payments for the IBM Blue Gene/P and for site preparations for the upgrade to 10–20 petaflops for the Argonne Leadership Computing Facility. The remaining $9 million begins the acquisition of an experimental prototype with hybrid architecture, a mix of standard processors and specialized processing engines that offer greater energy efficiency and computing power for the Oak Ridge Leadership Computing Facility. Both advances are critical to planning for exascale and meeting the immediate computational needs of the scientific community.

POWER REQUIREMENTS FOR EXASCALE

Mr. Pastor: What is the approximate power that would be needed for an exascale computer using present technology?

Mr. Koonin: The power required to operate Jaguar (a 2.2 petaflop Cray XT-5 system) is approximately 7 megawatts. Simple scaling to 500 Jaguars, which would be approximately an exaflop, would require 3.5 gigawatts. However, the 2008 DARPA exascale hardware study estimated that an exascale system could be delivered in 2018, assuming the realization of current industry roadmaps, with power requirements of approximately 200 megawatts. This is still too large to be feasible, and technology development is required to achieve another factor of 10 improvement in power efficiency.

THE NEED FOR EXASCALE COMPUTING

Mr. Pastor: What proportion of your Computer Sciences research would go to attacking the problems of exascale computing?

Mr. Koonin: In the FY 2011 budget request there is $5 million in computer science for advanced computer architectures research that directly addresses the challenges of exascale computing. In addition, there is $5 million in Research and Evaluation prototypes to begin exascale-relevant prototype research.

Mr. Pastor: Please cite some examples of pressing problems, presently beyond our reach, that can only be solved using exascale computers.

Mr. Koonin: A recent interim report to the Advanced Scientific Computing Advisory Committee from its subcommittee on exascale challenges and opportunities identified many areas of science and engineering that are important to the Department's mission and would be enabled by the availability of exascale computing capabilities. These include predictive simulation of combustion for transportation and power generation in an evolving fuel environment, predictive materials analysis tools necessary to increase nuclear fuel utilization and reactor life extensions, and the development of strategies and technologies to realize a significant reduction in oil imports and an 80 percent reduction from 2005 carbon dioxide emission levels by 2050. There are, of course, many NNSA applications as well.

GETTING TO EXASCALE

Mr. Pastor: Do you see a clear path to radically improved computer speed per input watt? Is the idea of using a development of today's video chips as exascale processor chips the most promising candidate?

Mr. Koonin: In the planning for exascale, the Department has identified a number of research paths that have the potential to dramatically improve computer capability per input watt. Our stretch goal is to deliver an exascale system that requires no more than 20 megawatts.

Mr. Pastor: The Department of Energy is exploring a number of technology paths that might lead to exascale capabilities. Systems that utilize future generations of graphical processing units (GPUs) are among the options under exploration.

How does the United States exascale potential compare to that of other countries?

Mr. Koonin: In the most recent international Top 500 list, released in November 2009, the Department's Leadership Computing Facility at Oak Ridge National Laboratory was the world's most powerful computing system. Eight of the top ten systems on this list were located in the U.S. and nine of the top ten systems were from U.S. manufacturers. However, a new entrant to this top ten was a system located in China that was assembled in China from U.S. components. In addition, the European Union has significantly increased funding in this area in an effort to become the "most dynamic competitive knowledge-based economy in the world". (International Exascale Software conference, April 12–14, 2010 in Oxford, England).

EXASCALE COLLABORATIONS

Mr. Pastor: In Fusion Energy Sciences, you have established a joint program with NNSA to avoid duplication of effort. Since NNSA also has a very strong interest in exascale, have you established a similar joint program for exascale?

Mr. Brinkman: Yes, the Department has established a joint exascale working group to strengthen the existing collaborations between these two programs and to develop a path to deliver exascale capability for the Department's science, energy and national security missions.

Mr. Pastor: How are NNSA and the Office of Science dividing up the work on exascale?

Mr. Brinkman: NNSA is focused on identifying requirements for national security applications, the Office of Science has been identifying science and engineering application requirements, and the two programs are collaborating closely on strategies to advance the underlying technologies.

Mr. Pastor: Would there be a net gain from an international cooperative project on exascale?

Mr. Brinkman: The National Science Foundation and the Department of Energy have jointly sponsored an International Exascale Software workshop series to identify the software requirements for exascale computing. The Department is evaluating the output from these workshops to identify areas where international cooperation would be mutually beneficial.

STATUS OF PROGRESS OF SMALLER AND FASTER PROGRAM GOAL

Mr. Pastor: Basic Energy Sciences is by far the largest program within your office, with $1.8 billion requested—more than double that of any of your other programs. If this large program were to be described by a single goal, I suppose it would be to look at ever-smaller units of matter, and to examine what happens in ever-shorter periods of time.

What is the current status of your progress on "smaller and faster?"

Mr. Koonin: The Basic Energy Sciences (BES) mission is to support research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels to underpin new energy technologies and to support DOE missions in energy, environment, and national security. The goal of reaching the ultrasmall length scale and ultrafast time scale is indeed an integral part of BES's core mission, as these are the fundamental scales where the processes of energy conversion take place. For example, the time scale associated with electron processes that dictate chemical reactivity and charge transfer is in femtoseconds (10^{-15} of a second), and the distances involved are less than one nanometer (10^{-9} of a meter). There have been exciting developments in pushing the limits on both the length and the temporal scales. The recent advances in aberration-corrected electron microscopy demonstrated imaging with sub-angstrom resolution while distinguishing individual atoms such as boron, carbon, nitrogen and oxygen. The successful commissioning of the Linac Coherent Light Source (LCLS) demonstrates that the world's most powerful x-ray laser can characterize processes that occur in less than ten femtoseconds (one hundredth of a trillionth of a second). While the theory of an x-ray free electron laser was developed over a decade ago, attaining such capabilities experimentally represents a major breakthrough in photon science. It signals the beginning of a new era in science where for the first time it is possible to not only see atoms but also how they move. This combination of "ultra-small" and "ultrafast" is the truly revolutionary capability of the LCLS. Early studies have shown the feasibility of obtaining images of biological nanocrystals and single viruses with nanometer resolution. These biological objects are so fragile that they actually get destroyed by the x-ray beam but the x-ray pulse is so fast that the picture is recorded before the aftereffect of the beam sets in and destroys the sample. Collectively, these capabilities will enable groundbreaking research in physics, chemistry, materials sciences, biology, and a host of other fields.

FUTURE BARIERS TO SMALLER AND FASTER

Mr. Pastor: In high-speed computing, as we move toward exascale, we are approaching the very steep barrier of a prohibitively high electrical power requirement.

In your drive toward smaller and faster in the Basic Energy Sciences program, do you see any similarly steep barriers approaching?

Mr. Koonin: Overcoming the barriers to further advance the temporal and spatial resolutions in material characterization will require new knowledge and scientific discoveries. While many of the new tools to reach for higher temporal and spatial resolutions will be extensions and combinations of current technologies, such as scanning probes, electron microscopes, synchrotron and laser light sources, etc., others will likely be developed based on future discoveries. One metric for ultrasmall is the diffraction limit, approximately the wavelength of the scattering particle. 100 KeV hard x-rays have a wavelength of 0.124 Angstroms, 300 KeV electrons have a wavelength of 0.02 Angstroms (an Angstrom is equal to 0.1 nanometers or 10^{-10} meters). The best resolution we can achieve with x-ray imaging is 10 Angstroms, electrons can image 0.5 Angstroms. Both theoretical limits are at least a factor of 10 smaller than current practice. Even the diffraction limit itself can be overcome, in metamaterials with a negative index of refraction. Thus we are far from any steep barriers in spatial resolution. In time resolution, the fundamental limit is the uncertainty principle. High harmonic lasers now produce pulse widths of a few hundred attoseconds, with the promise of shorter pulses on the horizon. By the uncertainty principle, the energy spread of such a pulse grows larger as the pulse grows shorter. Thus at attosecond time scales (10^{-18} of a second), the energy spread of the pulse will be larger than the spectroscopic transitions it intends to induce and measure. The limitation of ultrafast pulses is not in their production but in their utility.

In brief, current technologies still leave room for factor of ten advances in time and length resolution. Achieving these advances in ultrasmall and ultrafast resolution will require a sustained basic research program emphasizing control science at the electronic, atomic, and molecular levels.

SPALLATION NEUTRON SOURCE

Mr. Pastor: You make no request for the Spallation Neutron Source second target station, although the probable benefits of this project are immense. At the initial target station, the build out of instruments has passed the halfway point and nearly all the beamlines have been allocated.

What are your plans for the second target station?

Mr. Koonin: The development of the second target station at the Spallation Neutron Source (SNS) is in the BES long range plan. At present, BES is proceeding with the SNS power upgrade project, which will enable the second target station to be operated optimally and simultaneously with the first target station. In addition, BES is investing to enable the expansion of the user program and to complete the suite of instruments associated with the first target station. Many of the instruments in the first target station are still under construction, and we do not expect all of these instruments to be complete and commissioned until FY 2015.

SPALLATION TARGET SOURCE

Mr. Pastor: The Spallation Target Source has ten times the power of any comparable facility anywhere in the world, and is capable of research that cannot be performed anywhere else. It could lead to new physics beyond the Standard Model.

What is your strategy to ensure that the user community is able to fully exploit this tool?

Mr. Koonin: The Spallation Neutron Source (SNS) is an accelerator-based neutron source. It provides the most intense pulsed neutron beams in the world for scientific and industrial research and development. This powerful scientific tool gives researchers detailed snapshots of minute samples of physical and biological materials. By making fundamental neutron physics measurements, including the neutron electric dipole moment and neutron lifetime, SNS could potentially validate and probe new physics beyond the Standard Model.

To ensure the user community is able to fully exploit this tool, the Department has worked closely with SNS management, with input from the scientific community, to select, design, construct, and operate a suite of the world's best-in-class instruments for neutron science. Furthermore, the Department is committed to establishing a robust user program at SNS that will deliver high impact science. The ultimate goal is to provide scientists with the technical capabilities to count scattered neutrons, measure their energies and the angles at which they scatter, and map their final positions. Collectively, these capabilities will enable the SNS to achieve measurements of superior sensitivity, speed, resolution, and in complex sample environments. The Department will assess the effectiveness of the SNS operations and its user program, as well as its scientific productivity and technical progress on a triennial basis via rigorous, external peer review.

LINAC COHERENT LIGHT SOURCE AT SLAC

Mr. Pastor: I understand the Linac Coherent Light Source (LCLS) project not only was built on time and on budget, but your first scientific results were achieved sooner than expected for a new state of the art machine.

What does the scientific user community expect from the LCLS, and what are your long-range plans for photon science?

Mr. Koonin: The LCLS constitutes a revolutionary advancement in photon science. It combines the atomic resolution capability of x-rays with the ultrafast capability of conventional lasers. This capability became possible by employing frontier concepts in accelerator physics. High quality electron beams generated in a specially designed gun are accelerated to relativistic speeds and then compressed to a small volume. When these ultra-small bunches of charge are sent through long precisely engineered magnetic structures called undulators, all electrons in the tiny bunch radiate completely in tune and the generated x-rays are more than a billion times brighter than those produced by the most powerful existing sources. The ultrafast x-ray pulses are used much like flashes from a high-speed strobe light, enabling scientists to take stop-motion pictures of atoms and molecules in motion, shedding light on the fundamental processes of chemistry, technology, and life itself. The first three months of LCLS user assisted commissioning have already shown that the LCLS pulses are intense enough and bright enough to capture images of atomic and electronic events with a "shutter speed" of less than 10 femtoseconds. Molecular movies, revealing the inner workings of the atomic world are now within our reach.

Since its commissioning run in June 2009, the user interest in LCLS has been extremely high; 860 users have requested access through nearly 200 separate experiment proposals in the first few months of preliminary operations. The extraordinary accomplishments, achieved several months prior to the project completion (DOE Critical Decision 4), exceeded the community's expectations and surpassed all previous records set by other scientific user facilities within the U.S. and abroad. This demand also shows the strong enthusiasm and support for the world-leading capabilities offered by LCLS. To better serve the user community, BES is currently formulating a plan to increase the LCLS user capacity and to further enhance its technical capabilities, including increasing the number of parallel beams and extending the energy range.

In the longer term, other options to further extend the capabilities of storage ring sources and free electron laser facilities will be explored to ensure that the U.S. maintains world leadership in photon science. The detailed plan will be guided by the Basic Energy Sciences Advisory Committee (BESAC) report, *Next-Generation Photon Sources for Grand Challenges in Science and Energy*, which identified connections between major new research opportunities and the capabilities of the next generation of light sources. This BESAC report on future challenges in photon sciences is available at http://www.er.doe.gov/bes/reports/abstracts.html#NGPS.

Mr. Pastor: What is the international interest in LCLS, or is there a similar machine in Europe or Asia?

Mr. Koonin: LCLS currently operates as the world's shortest-wavelength Free Electron Laser (FEL) facility—the only one operating in the soft/hard x-ray range where most x-ray experiments are performed. There are large groups of users, foreign and U.S., that are applying for beam time at LCLS. In addition, there are international collaborations with U.S. scientists in place on specific instrument developments and new experiments that utilize the unique capabilities of the LCLS. However, U.S. leadership in x-ray science will be challenged as the FEL facility FLASH in Hamburg, Germany—which now just reaches the soft x-ray region—extends its range to shorter wavelengths and as two new hard x-ray FEL facilities come on line in the 2011–2015 time frame: an X-ray Free Electron Laser (XFEL) facility at Spring-8 (Super Photon ring-8GeV) in Hyogo, Japan, and the European XFEL at DESY (Deutsches Elektronen-Synchrotron) in Hamburg, Germany.

ATTOSECOND RESEARCH

Mr. Pastor: You are working toward laser pulses that are concentrated into attoseconds, or 10^{-18} seconds. This is a staggering concept to a world just beginning to get used to thinking in nanoseconds, which are 10^{-9} seconds. An attosecond is one billionth of a nanosecond.

This is intellectually thrilling, but what concrete benefits can we eventually expect from attosecond laser pulses?

Mr. Koonin: The generation and application of attosecond light pulses pushes the frontier of ultrafast science. The 2007 Basic Energy Sciences Advisory Committee report, *Directing Matter and Energy: Five Challenges for Science and the Imagination*, highlighted the potential use of attosecond pulses in pursuit of the first grand challenge: "How do we control material processes at the level of electrons?" The report noted that "attosecond science is fundamentally the science of electrons in atoms and molecules, and attosecond techniques may be capable of tracking electron dynamics inside atoms or molecules or on the atomic scale in condensed or solid matter." The ability to follow and control processes at the level of electrons, where quantum mechanics rules, holds enormous promise for the design of efficient energy technologies and could revolutionize computer technologies. For example, by exploiting the control of electron spins, one can envision developing a completely new generation of computer technologies that use the spin instead of charge of electron to power the devices. Such technology, termed spintronics, may help usher in the next generation of smaller, more affordable and more power-efficient devices.

Mr. Pastor: How much are you requesting for work leading to attosecond laser pulses?

Mr. Koonin: The incremental addition to the Basic Energy Sciences budget for all of ultrafast science in FY 2011 is $10 million. There is no specific allocation for the development and application of attosecond light pulses. The additional funding, if appropriated, will be openly competed across all ultrafast science topical areas and awards will be made on the basis of external merit review of the applications.

GAS HYDRATES

Mr. Pastor: Your budget request includes just over $17 million for basic research on gas hydrates. Last year, and for many years before that, the gas hydrates program was in the Fossil Energy applied science program, and was focused on how to bring this potentially important energy source into actual use. Your Office of Science program does work on many different energy sources.

How long will it take for most of the technologies or sources that you're working on to be market ready, if ever? How does this compare to the applied science programs like EERE and FE?

Mr. Koonin: There is a continuum spanning very fundamental work and efforts aimed at immediate application. Office of Science programs lean strongly toward developing an improved understanding of fundamental properties and processes in systems that have relevance for a variety of technological applications. The EERE and FE programs target the other side of the basic-applied research continuum, focusing on directed research and development aimed at individual technological applications, often working directly with industrial partners. The Office of Science does not develop technologies for the market; however its research does provide new opportunities for addressing short-term showstoppers and long-term grand challenges in energy technologies that could potentially penetrate the market

Mr. Pastor: Why did the Department transfer this program away from the applied Fossil Energy program?

Mr. Koonin: The Gas Hydrates program has been following two important research tracks: the first investigating the development of gas hydrates as a fuel resource and the second focusing on the role gas hydrates play in earth-atmospheric greenhouse gas dynamics. The investigation of gas hydrates as a fuel resource, which has been carried out with industrial partners in Alaska and the Gulf of Mexico and with international government partners, requires a greater focus on in situ properties of hydrates if it is to reach many of its objectives over the next several years. Continuation of the industrial partnerships beyond the drilling test programs increasingly will be dependent on market and business requirements. The role of gas hydrates in earth-atmosphere greenhouse gas dynamics can only be understood within a broader program of fundamental science investigations that are best suited to a research effort managed by the Office of Science.

Mr. Pastor: The gas hydrates program is being transferred from the Office of Fossil Energy to the Office of Science in FY 2011 to strengthen the fundamental science base for our understanding of methane hydrates: their formation and occurrence; their role in geological and ecological systems; their stability in natural and engineered systems; and their role in the carbon cycle.

Are there still basic energy science questions that must be answered before gas hydrates can move back to applied research? What are they?

Mr. Koonin: Gas hydrates occur naturally in a number of environments. Their fundamental stability needs to be better understood if they are to be economically viable as fuel resources. It is not a question of when gas hydrates are an appropriate target for further government funded technology development activities rather than it is a question of what additional information on gas hydrates will be needed by industry to make them a more attractive resource development opportunity. After significant research and development progress over the last decade, and completion of presently planned exploratory field investigations, we anticipate that the additional information required by industry will be apparent and that some of that information can only be addressed through additional basic research.

Mr. Pastor: How long would you estimate that gas hydrates are from being market ready? What are the limiting factors?

Mr. Koonin: The role of gas hydrates in energy markets primarily will be determined by economic factors, such as gas volumes that are large enough, geographic availability that is in close proximity to distribution systems, and profitable production costs. The current limiting technical factor is more efficient methods of methane production from hydrates, although, better characterization of the geographic distribution of gas hydrates and better identification of the gas volumes associated with different regions are also important.

FUELS FROM SUNLIGHT HUB

Mr. Pastor: You are requesting $24 million for the second year of funding for the Fuels from Sunlight hub. Last year we were very specific that in order for the Department to receive Committee support for the new hub idea, the Department would have to show very clearly how these hubs are succeeding.

What specifically did this hub do to move us closer to producing fuels directly from sunlight?

Mr. Koonin: The Fuels from Sunlight Hub will be a large, multi-disciplinary, highly collaborative team of scientists and engineers working over a five-year time frame to develop cost effective ways to create transportation fuels directly from sunlight. To achieve this goal, the Hub will address three critical issues: understanding and designing catalytic complexes or solids that generate chemical fuel from carbon dioxide or water; integration of all essential elements from light capture to fuel formation into an effective solar fuel generation system; and pragmatic evaluation of the solar fuel system under development. The Hub will be led by top researchers with the knowledge, resources, and authority to nimbly guide efforts, seizing new opportunities or closing off unproductive lines of research. Applications have been received in response to the Fuels from Sunlight Hub Funding Opportunity Announcement (FOA), and the review process is underway, as described below. The successful applicant will have identified research ideas and management plans to produce fuels directly from sunlight.

Mr. Pastor: The Department envisions these hubs as five year endeavors. By year, please describe for the Committee what this Hub is to achieve, and please submit for the record these benchmarks in detail. And please keep in mind that we will not count the amount of money awarded as a sign of success. This is a measure of process; we need to hear about progress. When will the proposals for this hub be evaluated and the award made?

Mr. Koonin: The Department is in complete agreement with the Committee that progress for a Hub should not be measured simply by funds awarded. Because none of the Energy Innovation Hubs have yet been awarded, it is premature to define to the Committee benchmarks for their progress in detail. However, the FOA for each Hub places a strong emphasis on the proposed management plan for the Hub as well as the output and goals of the research. Assessment of the management plan and the proposed output and goals from the research will be critical criteria in the merit review process to select the successful application. Once awarded, it is envisioned that the Hubs will use standard project management tools to track and measure progress towards these goals, providing detailed benchmarks over the duration of the award. The Department will assess the effectiveness of the management and the technical progress towards the goals on an annual basis via rigorous, external peer review. This process has been used to excellent effect in the three Bioenergy Research Centers, which serve as the model for the Hubs and which are making excellent progress toward their R&D goals.

Mr. Pastor: When will the proposals for this hub be evaluated and the award made?

Mr. Koonin: The deadline for receipt of applications in response to the Fuels from Sunlight Hub FOA was March 29, 2010. The full applications will undergo rigorous merit review, as described in the FOA. The award announcement is anticipated in June 2010, and the award will be implemented prior to September 2010.

Mr. Pastor: This hub is to develop an effective solar energy to chemical fuel conversion system. At what points to you evaluate whether the hub is on track for success or, as importantly, if it will not meet its objective?

Mr. Koonin: The Fuels from Sunlight Hub will undergo regular evaluations by Department-wide teams to assess its progress. These evaluations will include an early operations review of the Hub and annual assessments of its scientific and technical progress by external review panels.

Mr. Pastor: What will you do if it is not on track to meet its objectives?

Mr. Koonin: The Fuels from Sunlight Hub FOA did not prescribe specific objectives and deliverables because there is no existing commercial market for producing fuels directly from sunlight. Instead, the FOA required the applicants to connect their research proposal objectives to a practical solar fuel generation system. The Department sought the most innovative and aggressive solutions to the long-standing and extremely challenging problem of direct generation of chemical fuels from sunlight, water, and carbon dioxide, without the intermediate step of plant formation. The review plan I discussed will ensure that this Hub stays on track to meet its challenging overall objective and self-identified benchmarks during the first five-year award period. Corrective action plans will be put in place to address any issues identified by the peer reviews and other periodic assessments. If, at the end of the 5-year period, significant progress toward the objective has not been realized, as judged by independent merit review, renewal funding for the Hub will not be provided.

Mr. Pastor: What data are you collecting now and throughout the lifetime of the hub to ensure that you can measure the performance of the hub in comparison to hub applicants that aren't awarded federal funding, and in comparison to other Department programs that do not use the hub model?

Mr. Koonin: Hubs occupy a unique niche within the Department and provide a new R&D modality. Their integration over basic and applied research boundaries, pushing forward into technology development and deployment, cannot be found in any other single program within the Department. The Department recognizes that the competition for each Hub will be fiercely competitive and that, in making only one award per topical area, that some excellent applications will go unfunded. However, once established, the inherent flexibility and agility in a Hub will enable it to incorporate the most current and relevant R&D, regardless of origin, into the Hub to accelerate progress toward its objective.

Once awarded, the Hub will be subjected to regular monitoring and assessment to ensure that it achieves its goals and reaches its maximum potential. The types of data collected will be commensurate with the benchmarks and performance goals set forth in the approved research and development plan and the management plan. The Department anticipates the Fuels from Sunlight Hub will be world leading in developing a complete solar to fuel generator and will use the data to assess and validate its status.

BATTERIES AND ENERGY STORAGE HUB FOCUS AND DESIGN

Mr. Pastor: The budget request includes $34 million for a new batteries and energy storage energy innovation hub. The Department envisions these hubs as five year endeavors. By year, please describe for the Committee what this hub is to achieve, and please submit for the record these benchmarks in detail. And please keep in mind that, as with the Fuels from Sunlight hub, we will not count the amount of money awarded as a sign of success. This is a process indicator, not an outcome.

Mr. Koonin: As with the Fuels from Sunlight Hub, the Funding Opportunity Announcement (FOA) for the Batteries and Energy Storage Hub will place a strong emphasis on the proposed management plan for the Hub and the associated proposed outputs and goals for the research. Assessment of the proposed management plan and the proposed output and goals for the research will be critical aspects of the merit review process for the selection of the successful applicant. Once awarded, it is envisioned that the Hub will use standard project management tools to track and measure progress towards these goals, providing detailed benchmarks over the life of the award. The Department will assess the effectiveness of the management and the technical progress towards the goals on an annual basis via rigorous, external peer review. Because the Hub has not yet been awarded, it is premature to define benchmarks for its progress in detail.

Mr. Pastor: What will be the yardsticks against which performance of the hubs will be judged?

Mr. Koonin: The Hubs will be assessed against the goals and outcomes that were outlined in their application and the subsequent project management schedule that will be provided during the first months of the award. The annual peer reviews of their management and technical progress will provide the "yardstick" for their research performance. In addition, the Hub's leadership in energy storage research and development, as well as the rate at which advances of their research are transferred to or impact industry, will be evaluated as a measure of the success of the Hub. Within the Department, there will be an Energy Innovation Hubs Oversight Board that will periodically review the progress of the all of the Hubs. The Hub Oversight Board will consist of the Secretary, the Under Secretary for Energy, and myself, and our senior scientific/technical advisors.

COORDINATION AND REDUNDANCIES BETWEEN HUB AND OTHER PROGRAMS

Mr. Pastor: The Department also has funding for research into batteries and energy storage in the Advanced Research Projects Agency-Energy (ARPA-E), the Office of Energy Efficiency and Renewable Energy (EERE), the Energy Frontier Research Centers, and the Office of Electricity Delivery and Energy Reliability (EDER). According to the Department, these programs operate along a spectrum, with Science programs funding basic research into next-generation technologies, ARPA-E funding "high-risk, high-reward" work, and EERE funding R&D for technologies that can be deployed in the short and medium term. This implies a need for some level of coordination among these programs.

How do you propose that this new hub coordinate and collaborate with the programs working on the same topic across the Department of Energy?

Mr. Koonin: The Department's Energy Storage Working Group ensures communication and coordination of energy storage research across the Department. This activity is overseen by the Under Secretaries and the principals of the Offices of Science, Energy Efficiency and Renewable Energy, Electricity Delivery and Energy Reliability, and ARPA-E.

In addition, the Hubs Working Group, composed of senior career leaders, coordinates the formulation of the Hubs to ensure similar processes are used for all of the Hubs. The Energy Innovation Hubs Oversight Board (the Secretary, the Under Secretary for Energy, and myself, and our senior scientific/technical advisors) will provide additional assurance that these activities are effectively managed and coordinated.

Mr. Pastor: As described to us, the hub would take on the broad spectrum of scientific challenges to chemical energy storage, while the EFRCs each focus on a single slice of that puzzle. It seems a missed opportunity if the EFRCs and the hub are each operating in a vacuum.

What do you intend to do to make sure that the EFRCs collaborate with the hub?

Mr. Koonin: The co-location of the EFRCs and leadership of the Batteries and Energy Storage Hub within the Office of Science's Basic Energy Sciences (BES) program will ensure the coordination of these activities. The Hub will be a full participant in BES contractor meetings focused on Energy Storage and related scientific topics. In addition, the EFRCs meet regularly through monthly teleconferences and in person twice per year in association with BES Advisory Committee meetings. As appropriate, the Hub will be part of these meetings, including technical interactions with the EFRCs focused on Energy Storage.

Mr. Pastor: Across the Department, why wouldn't it make sense to apply more money to near-term changes, since many of the most severe problems that we're facing in our energy sector are problems that need solutions today?

Mr. Koonin: Establishing a focused energy storage research and development effort the size, scope, and duration of an Energy Innovation Hub will garner long-term commitment from many of our most innovative researchers on these challenges. Given this concentration of expertise and scientific leadership, it is expected that the Hub will have an impact within the five years of funding, providing insights and new technologies that will contribute to the solutions of today's problems. The Hub's ultimate technological goals include the development of radically new concepts for producing storage devices from materials that are abundant and have low manufacturing cost, high energy densities, long cycle lifetimes, and high safety and abuse tolerance for a broad range of energy storage applications. Attaining all of these goals will require the sustained research and development of the Hub environment, and will result in innovative solutions and economic leadership in this competitive field for the future of the Nation.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH OVERVIEW

Mr. Pastor: Your request is essentially static on Biological Systems Science, with a modest 7% increase in Climate and Environmental Science. The Secretary has described climate change as one of his two primary challenges.

Does this mean we should expect significant increases in requests for Climate and Environmental Science in the future?

Mr. Koonin: Climate Change is a priority in the FY 2011 budget and will continue to be a priority. Future funding decisions will be made in the context of the overall federal budget.

CLIMATE MODELING TO REDUCE UNDERTAINTY OF CLIMATE FORECASTING

Mr. Pastor: This year's request for the Office of Science includes additional efforts to improve climate modeling software, systems, and data collection.

Can you explain how these activities will advance climate modeling and—most importantly—how they will decrease uncertainty in the climate model forecasts?

Mr. Koonin: Current models have an unacceptably large range of uncertainty, due to differences in the simulation of feedbacks and insufficient information to properly constrain model parameters. The additional climate modeling activities proposed for FY 2011 directly address these challenges as well as complement current BER modeling activities. These new activities will advance climate modeling by quantifying and reducing uncertainties. One activity will support enhanced efforts to better represent the feedbacks produced by the indirect effect of aerosols, a major uncertainty. A second activity will focus on converting observational datasets into specialized, multi-variable datasets for model testing and improvement. A third activity establishes model development testbeds in which model components can be rapidly prototyped and evaluated using integrated observational datasets, like those described above. A fourth activity is the development of enhanced tools for uncertainty quantification for climate model simulations and predictions, based in part upon work in the NNSA's Stockpile Stewardship program. A fifth activity focuses on the development of numerical methods to enable climate models to effectively use future computer architectures.

The first three areas coupled with leadership computing resources can reduce the uncertainties. The fourth addresses a major gap in climate modeling: uncertainty quantification.

Collectively, these efforts are intended to address a critical and relatively straightforward objective—accelerating the incorporation of new knowledge including process data and observations into climate models and to develop new methods for rapid validation of improved models. A crosscutting objective is to develop novel approaches to exploit computing at the level of many tens of petaflops in climate models. These challenges are recognized broadly in the climate community and DOE is well equipped to address them.

Mr. Pastor: How will you coordinate these efforts with those of other agencies?

Mr. Koonin: BER has a longstanding history of successful interagency collaborations in climate research. These activities will be integrated with Federal efforts outside the Department through the United States Global Change Research Program (USGCRP), particularly those programs from the other primary agencies that support basic climate research: NASA, NOAA, and NSF. For example, we leverage our ongoing collaboration with NSF in the development of the Community Climate Science Model. The additional FY 2011 efforts benefit from our ongoing efforts with NOAA to optimize the application of high performance computing to meet the challenges of high resolution, fully coupled earth system models; and will accelerate the integration and ground-validation of NASA's satellite measurements and capabilities.

COMBUSTION MODELING

Mr. Pastor: Your budget request includes $20 million for a new combustion research program, which proposes to use advanced computers and models to develop advanced combustion engine designs. This seems to be a worthwhile objective to help improve our engines, but why isn't this in the Fossil Energy or Energy Efficiency and Renewable Energy programs?

Mr. Koonin: The new BES activity in this area in FY 2011 is specifically devoted to a concerted program in fundamental combustion chemistry and fluid dynamics to enable a predictive simulation of advanced engines burning fossil and alternative fuels. This activity is not appropriate to Fossil Energy because the BES activity focuses on combustion pertinent to advanced internal combustion engines for the transportation sector, while Fossil Energy's programs on combustion are focused primarily on stationary power plants burning fossil fuels for electricity production. This new activity will be closely coordinated with the Vehicle Technology Program within the Office of Energy Efficiency and Renewable Energy, which supports a complementary program of more applied research on internal combustion engines. The Office of Basic Energy Sciences and the EERE Vehicle Technology Program have a long-standing and fruitful record of collaboration.

Mr. Pastor: $20 million is a nice round number. How was it determined, and what specifically will it buy?

Mr. Koonin: The requested funding is appropriate to the level of effort required in critical areas of emphasis: computational chemistry; benchmark combustion simulations; and experimental validation, verification, and discovery. In the computational thrust, research will focus on the automated discovery of chemical reaction mechanisms for complex fuels, on the reduction of chemical mechanisms so they are amenable to incorporation into fluid dynamics codes, and on benchmark numerical simulations of turbulent combustion in canonical systems intended to model new engine designs, such as homogeneous charge compression ignition. A complementary experimental thrust is critical for the validation and verification of computationally derived models and for the discovery of key reactions and new combustion intermediates. Advanced chemical imaging of reacting flows will be developed to track chemical intermediates in time and space, in multiple phases, and under the low-temperature, high-pressure conditions appropriate for new engines.

Mr. Pastor: What specifically will you request in future years to support this initiative?

Mr. Koonin: The Department recognizes that advanced combustion simulation may be of enormous benefit to the design of the next generation of efficient, fuel-flexible, and cost-effective internal combustion engines. There are also implications for US competitiveness. Budget requests in future years will reflect the opportunity afforded by simultaneous advances in fundamental science, simulation capability, and validation methodologies that now make it feasible to develop fully predictive combustion models.

ITER INTERNATIONAL FUSION ENERGY COLLABORATION

Mr. Pastor: The International Thermonuclear Experimental Reactor (ITER) has a conspicuous history of schedule slippages and cost overruns. I understand that attempts to do what has never been done before will be slower and more expensive than originally estimated, but ITER raises the question of how far that tolerance can be taken. Your budget request cuts $50 million from our annual contribution to the ITER project.

I understand that there have been some recent problems with this project's management, delays in international commitments to funding levels and timelines, and cost estimate increases, which have led to this proposed cut. Please explain to the subcommittee the problems that this project has been facing. What is being done to fix them?

Mr. Brinkman: The project has been facing challenges in achieving a final credible project baseline. The fundamentals of these problems are being aggressively addressed by the Office of Science in concert with the ITER partners._We are currently applying judicious pressure on the other ITER Members to resolve the longstanding questions of achieving the project baseline and making management changes that will smooth the transition from start-up to construction in the project. . We hope to see some of these problems addressed by the June 2010 ITER Council Meeting (IC-6).

Mr. Pastor: Please submit for the record the originally projected annual contributions, both from this country and the rest of the international community. Is this still the plan of record? If not, what is the plan of record?

Mr. Brinkman: The initial cost estimate for the U.S. contributions to ITER was set at $1.122 billion in 2003, based on a set of assumptions of scope, schedule, commodity costs, labor and exchange rates. All of these were further refined as understanding of the requirements to establish the site, scope and schedule matured.

The ITER Joint Implementation Agreement (JIA) provides for in-kind contributions from the Members. In-kind means that each Member is allocated certain project scope, to be built according to agreed specifications within their domestic industries. Upon delivery, Members are credited by the ITER Organization for this portion of their contribution according to assigned value under the JIA. This provides a level of protection to the U.S. from others' cost overruns, but also obscures the true cost of providing their scope. Additionally, each country calculates and budgets for the cost of their scope differently, making it difficult to compare across countries.

The U.S. is currently operating under a cost range established at Critical Decision-1 (CD-1) as prescribed by DOE Order 413.3a. The range is currently between $1.45 billion and $2.2 billion. This range will be refined and a cap will be set on cost at CD-2

Mr. Pastor: How much of the request would be spent in the United States on work to support the ITER project? How does this compare to last year?

Mr. Brinkman: The JIA calls for a roughly 80% in-kind contribution and a roughly 20% cash contribution over the life of the project, though the exact allocations will vary from year to year, depending on the nature of activities at that stage of the project. The full cost of delivering the in-kind contribution includes management, design, fabrication and delivery of our in-kind allocation. This work is mostly contracted out to industry in the U.S. by the U.S. ITER Project office. The approximately 20% cash contribution includes the cost of ITER Organization project management and assembly of the machine and other common expenses.

Mr. Pastor: International cooperation is a great thing, but at what point would the slow rate of progress by other members become prohibitive?

Mr. Brinkman: The establishment of a baseline schedule, combined with more appropriate management structure at the ITER Organization, would make us more optimistic about the success of the project. We expect to see progress on these by the June 2010 ITER Council Meeting (IC-6).

Mr. Pastor: At what point would the Department of Energy decide that further U.S. investment in ITER is not warranted?

Mr. Brinkman: We believe we are making progress on the schedule and management. As with all our projects, however, we will continue to assess the adequacy of that progress.

ITER TECHNICAL CHALLENGES

Mr. Pastor: According to one French physicist discussing ITER, “We say that we will put the sun into a box. The idea is pretty. The problem is, we don’t know how to make the box.”

Are you confident that we will be able to make the box?

Mr. Brinkman: There is a strong consensus in the scientific community that we are ready for the step that ITER represents, and that such a step is essential. This point of view is strongly articulated by the National Academies Report, “Burning Plasma: Bringing a Star to Earth (2003).” The conclusion is grounded in decades of scientific research in magnetic fusion.

ITER DIFFICULTIES WITH FRENCH REGULATORY REQUIREMENTS

Mr. Pastor: How significant are the difficulties caused by trying to harmonize American hardware with EU and French nuclear regulatory requirements? Are we looking at a dead end in this respect, or is there a light at the end of this tunnel?

Mr. Brinkman: U.S. contributions of in-kind components are either fabricated from build-to-print design specifications (in which case they should meet French regulatory requirements prior to fabrication), or from functional specifications (in which case the U.S. will be responsible for providing built-to-print design specifications). In the case of functional specifications, the design work provided by the U.S. will be fully vetted and approved to French regulatory requirements prior to finalization as build-to-print specifications and fabrication.

Mr. Pastor: What strategies are you considering to resolve this conflict?

Mr. Brinkman: The U.S. ITER Project Office, the ITER Organization and the other ITER Members are all fully engaged with the French regulators to ensure that the components supplied will meet requirements and that the final ITER assembly will be permitted to operate.

INERTIAL CONFINEMENT FUSION ENERGY

Mr. Pastor: It seems as if the Office of Science has put all of its fusion eggs into the magnetic confinement fusion basket, largely through investments in ITER. But there is also the potential of inertial confinement fusion. Popular attention is on the National Ignition Facility and Lawrence Livermore National Laboratory for proof of ignition this year, but the Naval Research Laboratory (NRL) just south of this hearing room has already done interesting work, with tens of thousands of successful shots. Why doesn't the Office of Science invest in inertial confinement fusion energy research? Have you specifically evaluated the potential of inertial confinement fusion versus magnetic confinement fusion for energy purposes?

Mr. Brinkman: Inertial Confinement Fusion (ICF) has been supported by the NNSA for many decades, primarily for national security and scientific applications, although with a long-term view toward potential energy production. The current program is some $0.5 billion per year centered on the initial operation of the National Ignition Facility at LLNL. There is a related, but separate science program in High Energy Density Laboratory Plasmas jointly funded by the NNSA and Fusion Energy Sciences at about $30 million per year.

The NNSA program will pass a major milestone later this year with the start of the National Ignition Campaign (NIC), a series of experiments aimed at demonstrating laboratory ICF ignition within a few years. Any Inertial Fusion Energy (IFE) program would require a successful ignition campaign, which is anticipated but not guaranteed.

In anticipation of ignition at NIF, the Department has begun laying the groundwork for an IFE program. The Under Secretary for Science has coordinated several department elements (NNSA, SC, and NE) in chartering an NAS study to define a technology roadmap for IFE. The major energy technology challenges to be considered include rep-rated drivers, inexpensive target fabrication, target injection, and balance of system, all of which are little addressed by the current national security and science programs. An interim report is expected in 9 months and a final report in 21 months. The Under Secretary is also leading internal discussions of organizational and management structures that would allow this NNSA-developed capability and the Office of Science expertise to be focused on a potentially revolutionary energy technology. We have not performed a comparative study of magnetic and inertial fusion energy.

Mr. Pastor: The Office of Nuclear Energy, in conjunction with the Office of Science, was directed last year to evaluate the NRL program and submit a report to the Committee on its business plan. The direction was intended to provide the Committee with perspective on whether this program should be provided additional support. I'm told that DOE is working with the National Academies of Science to do a complete Fusion evaluation. What's the timeline for that report?

Mr. Brinkman: The NAS has committed to delivering an interim report regarding inertial fusion energy nine months after the study commences, which equates to a delivery in the first quarter of calendar year 2011. The final report is due one year later. The published final version will be available three months after that.

Mr. Pastor: If the study concludes that inertial confinement fusion is a potentially viable energy source and high-repetition-rate experiments are a useful tool for working in this direction, will your office reconsider its investment strategy regarding NRL?

Mr. Brinkman: How DOE might respond in general terms to a strongly positive report, including how inertial fusion energy would be managed within DOE in that circumstance, is being evaluated. With appropriate roles and responsibilities defined with the Department, proposals from NRL and any potential research partner would then be assessed within the Department.

Mr. Pastor: What is the status of the NRL program? I understand that the Department has made some funds available to avoid laying off essential NRL personnel. Has the Office of Science contributed any funds? If not, why not?

Mr. Brinkman: For the Office of Science, funding of proposed activities is based on considerations of merit review, program balance, and funds available at the time of consideration. A proposal from NRL submitted to the Office of Science was declined based on these factors. Our understanding is that NNSA is in communication with NRL.

STATUS OF THE LARGE HADRON COLLIDER

Mr. Pastor: The Large Hadron Collider (LHC), which recently began operation near Geneva, Switzerland but gets significant funding through the Department of Energy, has had serious problems in the past. What do you now understand to have been the cause of the 2009 shutdown?

Mr. Koonin: The incident that resulted in the LHC shutdown for repairs during most of 2009 was caused by a faulty electrical connection between two superconducting magnets. A short-to-ground caused the entire string of superconducting magnets in the power circuit to rapidly discharge all of their stored energy. This rapid discharge caused the magnets to quench, boiling off the liquid helium that keeps them superconducting and creating an enormous pressure inside the magnet enclosures. The large sudden pressure increase, combined with the lack of a sufficient pressure release mechanism, led to the incident that damaged over 50 superconducting magnets. After understanding the cause of the September 19, 2008 incident and replacing and fixing the damaged magnets, CERN repaired over 200 faulty or suspect electrical connections. Additional pressure relief valves were installed and a new quench protection system was put in place to prevent damage to the LHC from any future quenches.

The LHC began operations again in November, 2009, and collisions were achieved for the first time in December 2009 at low energies and very low luminosities. After a planned shutdown for routine maintenance in early 2010, the LHC started operating again in February.

Mr. Pastor: What level of luminosity has now been reached? Are any significant problems now evident preventing the LHC from reaching its target energy levels?

Mr. Koonin: Collisions at 3.5 trillion electron volts (TeV) per beam were achieved on March 30, 2010. The LHC is now running at low luminosity, as expected for a machine of this complexity that just started operations. It is expected that the LHC will reach an instantaneous luminosity of $2x10^{32}$ collisions per square centimeter per second in 2010 (comparable to the current luminosity at the Fermilab Tevatron) and accumulate approximately 1 inverse femtobarn (fb^{-1}) of data by the end of 2011.

Mr. Pastor: Are any significant problems now evident preventing the LHC from reaching its target energy levels?

Mr. Koonin: The repairs in 2009 revealed that additional electrical connections need to be replaced in other sectors of the LHC (beyond those damaged in the 2008 accident) before the magnet currents can be safely ramped up to sustain the full LHC design energy of 7 TeV per beam. Earlier this year, CERN decided to run the LHC at 3.5 TeV per beam during 2010–2011 and then to stop for a full year of repairs in 2012. After repairs, the LHC will re-start operations at its full design energy of 7 TeV per beam. We are not aware of any issues that will prevent this goal from being attained.

DIRECTION OF HIGH ENERGY PHYSICS

Mr. Pastor: Assuming the Large Hadron Collider reaches its target performance levels, it will lead the world in high-energy particle physics—and it is located in Europe. Now that the United States does not expect to host the leading facility for high-energy particle physics, we're told that the Department is considering further developing its high-intensity physics capabilities as an alternative direction. What direction is High Energy Physics program heading?

Mr. Koonin: We plan to maintain a U.S. leadership role in the worldwide high energy physics research effort, including major domestic research facilities as well as participation with international partners in forefront research located at facilities abroad. This approach was recommended by the National Academy of Sciences and the High Energy Physics Advisory Panel (HEPAP) in their most recent long-range plans for high energy physics.

The key scientific questions in elementary particle physics, as articulated by the most recent HEPAP long-range plan, can be categorized into three interlocking Frontiers: the Energy, Intensity, and Cosmic Frontiers. New results from the Large Hadron Collider will define research at the Energy Frontier, but they will also inform and impact other particle physics research at the Intensity and Cosmic Frontiers, and vice versa.

Based on the input from the scientific community, the High Energy Physics program formulated a strategic plan that exploits unique capabilities and infrastructure in the U.S. to develop and deploy a world-leading program in neutrino physics and rare particle decays at the Intensity Frontier. This program entails a phased evolution of the Fermilab accelerator complex and the development of large underground detectors in partnership with the National Science Foundation. The first elements of this scientific campaign, including funding for the conceptual design of the Long Baseline Neutrino Experiment and the Muon to Electron Conversion Experiment, are included in the FY 2011 Budget Request.

This scientific campaign is part of a balanced High Energy Physics program that includes leadership roles for U.S. scientists at the Energy and Cosmic Frontiers, as well as a strong program of advanced technology R&D to make the breakthroughs that will enable the next generation of research leadership for High Energy Physics and other Office of Science programs.

Mr. Pastor: If you do not know now, by when do you plan to determine the program's direction?

Mr. Koonin: We find the HEP strategic plan to be well-determined, though it is flexible enough to respond to new physics results from the LHC or other experiments, or changing circumstances regarding international or interagency collaborations, which may change one's view of the scientific priorities at the Frontiers and what can be accomplished within plausible budget scenarios. We will ask HEPAP to revisit the long-range plan as circumstances warrant.

DECREASE IN FUNDING FOR NON ACCELERATOR PHYSICS

Mr. Pastor: In High Energy Physics, you are requesting an 11% decrease in Non-Accelerator Physics, while all other High Energy Physics requests are flat or slightly up.

Please explain the reason for this.

Mr. Koonin: The overall decrease in Non-Accelerator Physics is due to the SuperCDMS at Soudan, Dark Energy Survey, and Reactor Neutrino Detector projects completing fabrication per their planned funding profiles and moving to the commissioning and operations phase. The decrease in project funding is partially offset by an increase in research funding for the scientists to participate in the operations and data analysis of these experiments.

MOLYBDENUM-99 ISOTOPE PRODUCTION

Mr. Pastor: The primary supplier of the medical isotope Molybdenum-99 (moly-99) for the U.S. is the Canadian Chalk River CANDU reactor. The reactor has had a number of unscheduled shutdowns in recent years that caused critical shortages of moly-99, which is used to diagnose diseases. An effort is underway to establish a domestic supply as quickly as possible. The request of $119 million for research reactor conversion in NNSA includes $30 million, $10 million above fiscal year 2010, to accelerate the establishment of a domestic supply of this isotope.

What is the Office of Science's role in this area?

Mr. Brinkman: NNSA has the lead within the Department of Energy for the establishment of a domestic supply of Mo-99. The Office of Science, working closely with NNSA, provides technical and project management support as appropriate.

Mr. Pastor: Your Budget Justification indicates that the Brookhaven Linac Isotope Production Facility, Oak Ridge National Laboratory, and the Advanced Test Reactor at the Idaho National Laboratory all have significant roles in isotope production. Do any of them have potential to produce moly-99?

Mr. Brinkman: The High Flux Isotope Reactor and the Advanced Test Reactor (ATR) both have the potential to produce Mo-99; however substantial changes would be required to establish production capability. Both of these reactors have primary missions other than medical isotope production. Mo-99 production would impact these missions. These options were considered by an OSTP-led Interagency Working Group which concluded that international cooperation and coordination amongst current Mo-99 producers is a more cost-effective and productive route in mitigating the Mo-99 shortage.

PLUTIONIUM-238 ISOTOPE PRODUCTION

Mr. Pastor: The Office of Nuclear Energy (NE) has historically been responsible for supporting the plutonium-238 isotope program, which provides power sources for government applications such as space missions. However, our supplies of this isotope are running out. This year, NASA's budget contains $15 million to match the $15 million provided in NE's budget to re-establish a plutonium-238 production program.

Do any Office of Science missions rely upon plutonium-238? If so, does your budget contain any funding to support NE's re-establishment of the program?

Mr. Brinkman: Office of Science missions do not rely upon plutonium-238 and the Office of Science budget does not contain funding in support of the re-establishment of the program.

Mr. Pastor: Pu-238 is a very difficult element with which to work. Has the Office of Science considered establishing a program to develop different power sources for the same missions?

Mr. Brinkman: In their report, *Radioisotope Power Systems: an Imperative for Maintaining U.S. Leadership in Space Exploration*, 2009, the National Research Council examined the question of potential alternative isotopes for NASA missions and concluded that no other isotope meets or exceeds the safety and performance requirements, particularly for long-duration, deep-space exploration missions.

NATIONAL STRATEGIC PLAN FOR ISOTOPE PRODUCTION

Mr. Pastor: The Nuclear Science Advisory Committee issued a report in April 2009 establishing priorities for the production of research isotopes. This led to a long-term strategic plan for the program, issued in November. How does your budget request support the strategic plan?

Mr. Koonin: The Nuclear Physics FY 2011 Budget Request includes funding for research and development efforts to develop new production and processing techniques of isotopes, an effort initiated when the Isotope Program was transferred from the Office of Nuclear Energy to the Office of Science in FY 2009. Awards in FY 2009 and FY 2010 were competitive and based on merit peer review; the priorities determined by the Nuclear Science Advisory Committee were instrumental in the decision-making process. The Isotope Program is actively conducting pre-conceptual R&D on stable isotope production techniques, as recommended by NSAC. It is anticipated that these activities would continue in FY 2011. The FY 2011 Budget Request also includes funding for operations of a suite of federal, laboratory and university facilities for the production and processing of research isotopes. The Isotope Program has been pursuing options for increased and more reliable radioisotope production, including broadening the suite of utilized production sites, which is supported in the FY 2011 Budget Request. The FY 2011 Budget Request also supports the newly established National Isotope Data Center that will strengthen interactions and communication with stakeholders and isotope users.

Mr. Pastor: What are the responsibilities of other agencies or parts of DOE? Do their budgets fully support this strategic plan? If not, what are the gaps?

Mr. Koonin: The Isotope Program within the Office of Science Office of Nuclear Physics utilizes facilities to produce isotopes whose primary operations are supported by a program outside the DOE Office of Science, or where the isotope facility is dependent upon the operations of a larger accelerator within the Department of Energy for its operations. The High Flux Isotope Reactor is operated by the Office of Science Office of Basic Energy Sciences and the Isotope Program provides support to this facility to produce select isotopes; the FY 2011 President's Request from the Office of Basic Energy Sciences includes funding to operate and maintain this facility. The Brookhaven Linac Isotope Production facility operates parasitically to the Relativistic Heavy Ion Collider (RHIC), a facility with a basic research mission and also supported by the Office of Nuclear Physics; the FY 2011 President's Request from the Office of Nuclear Physics includes funding to operate and maintain RHIC. Lastly, the Isotope Production Facility (IPF) operates parasitically to the Los Alamos Neutron Science Center (LANSCE) facility, operated by NNSA. The IPF uses a portion of the H^+ beam extracted at 100 MeV from the LANSCE accelerator; this facility produces a variety of radioisotopes for use in medical diagnosis and treatment and for scientific research. Operations and enhanced maintenance of the LANSCE facility are included in the FY 2011 NNSA Request.

Mr. Pastor: Please submit this plan for the record.

Mr. Koonin: The report is available at http://www.sc.doe.gov/np/nsac/docs/NSACI_II_Report.pdf, and I will provide a printed copy as well.

NSACI_II_Report.pdf

ISOTOPE PRODUCTION AND DISTRIBUTION PROGRAM FUND

Mr. Pastor: Dr. Koonin, the fiscal year 2009 balance in the Isotope Production and Distribution Program Fund was $59.2 million, of which $14.8 million was from the Recovery Act, $19.6 million was from collections resulting from isotope deliveries, and $24.8 million was from direct appropriations. How much is currently in the Fund?

Mr. Koonin: Unobligated balances in the revolving fund on September 30, 2009 were $24.2 million. FY 2009 deposits into the revolving fund totaled $64.7 million which included $14.6 million of Recovery Act funds, $24.8 million of appropriated funds, and $25.3 million from sales (of which $19.6 million is revenue). As of the end of March 2010, $18 million is currently in the fund.

Mr. Pastor: How are the Recovery Act dollars being spent? Over what timeframe? What are you projecting the balance in the Fund to be at the end of fiscal year 2010?

Mr. Koonin: Recovery Act dollars in the isotope fund are being spent for enhanced utilization of isotope facilities and R&D on alternative isotope production techniques. $10M has been provided through existing M&O contracts with the Brookhaven, Los Alamos, Oak Ridge, and Idaho Laboratories for enhanced production efforts for 3 to 5 years, and investments in production and processing capabilities. As part of this allocation, $1 million will be spent in FY 2012 to purchase select stable isotopes used by these applications, and which had been depleted in the stable isotope inventory at Oak Ridge National Laboratory.

Enhanced production will increase the availability of research isotopes in short supply and investments in production and processing equipment at the facilities will minimize production interruptions and address single point failures. $4.6 million has been provided through existing M&O contracts with the Los Alamos National Laboratory and Oak Ridge National Laboratory for R&D on alternative isotope production techniques for 3 to 5 years for new or improved methods to produce radioisotopes for the Nation's needs. Many isotopes are in short supply and alternative production techniques need to be developed in order to meet the needs of the Nation for research, medicine, homeland security, and industrial applications.

The revolving fund allows continuous and smooth operations of isotope production, sales, and distribution when there are fluctuations in the federal budget cycle and sales. The fund's revenues and expenses are audited annually consistent with Government Auditing Standards and other relevant laws, such as the Chief Financial Officers Act of 1990 and the Government Performance and Results Act of 1993. The unobligated balance in the revolving fund at the end of fiscal year 2010 is projected to be about $11 million. This amount includes advance payments from customer sales and reserves held to maintain financial viability of the revolving fund to support unanticipated changes in sales volume and unforeseen equipment repairs.

NEW FORM OF MATTER

Mr. Pastor: Your request for Nuclear Physics mentions a recent discovery of a new form of matter, a perfect liquid thought to have existed only moments after the birth of the universe.

Where do we find this new matter in nature? Is there anything to be learned from it that would be applicable here on Earth?

Mr. Koonin: The new form of matter discovered at the Relativistic Heavy Ion Collider (RHIC) is believed to have existed naturally about ten millionths of a second after the birth of the universe when it had cooled to a temperature of approximately one trillion Kelvin. After further cooling, the matter which makes up the present day physical universe was formed. It is unlikely that the matter made in the laboratory at RHIC exists naturally in the universe today.

Results from studying the properties of the new form of matter discovered at RHIC indicate it has unique characteristics which can advance knowledge of the fundamental symmetries of nature, the origin of mass, and universal properties of physical systems (for example collections of excited atoms) in which the constituents interact strongly with one another. In addition, similarities in the interaction between the constituents of the matter discovered at RHIC and the interaction between the constituents of some nano-materials (for example single layers of graphite, known as graphene) are being studied for possible analogy and insight into the use of graphene as a conductor of spin-polarized electric current, with possible application to the creation of re-writable spintronic circuits. Spintronics, also known as magnetoelectronics, is an emerging technology that exploits the intrinsic spin of the electron and its associated magnetic moment, in addition to its fundamental electronic charge, in solid-state devices. Future applications may include a spin-based transistor having advantages over Metal Oxide Semiconductor Field Effect Transistor (MOSFET) devices that are currently in use.

GRADUATE FELLOWSHIPS

Mr. Pastor: Mr. Brinkman, your budget request includes $15 million for Graduate Fellowships, a tripling of last year's appropriation. These fellowships are apparently to support students in basic research areas important to the Department, such as physics, chemistry, biology, mathematics, computer science, and engineering. Obviously, I'm all for supporting developments in these fields, but I'm not for encouraging the developing of duplicative bureaucracies. The Department of Education already operates a $31 million program called "Graduate Assistance in Areas of National Need", which provides fellowships to graduate students working in areas of national need, such as physics, chemistry, biology, mathematics, computer science, and engineering.

Is your program at all coordinated with that of the Department of Education? What differentiates this program in the Office of Science from the Department of Education's program? Why should we be supporting two bureaucracies to do such similar programs, rather than work with the Department of Education to fill any gaps that you perceive in its existing program? The Education program requires institutions to provide matching funds, thereby leveraging non-federal dollars. Does yours?

Mr. Brinkman: The DOE Office of Science Graduate Fellowship (SCGF) was created in FY 2010 to meet the mission requirements of the Office of Science, which supports a highly technical workforce to conduct fundamental research in physics, basic energy sciences, and major areas of the life sciences, mathematics, and computation.

The DOE SCGF program is distinctly different from the Department of Education's Graduate Assistance in Areas of National Need (GAANN) program in several respects.

First, the DOE SCGF is awarded directly to graduate students pursuing an advanced degree (Masters or Ph.D.) in science, mathematics, or engineering and students apply and compete for the fellowships. The GAANN program is awarded to academic institutions of higher education, which compete for the award, and the academic institution distributes the fellowship award to its students. Second, the DOE SCGF is awarded to graduate students who are pursing advanced degrees and graduate studies in areas of basic research in science, mathematics, or engineering importance to the Department of Energy. Institutions granted the GAANN award provide their fellowships to graduate students pursuing degrees in any academic discipline determined to be an area of national need by the Department of Education in consultation with the Department of Defense, the Department of Homeland Security, and the National Science Foundation. Third, the DOE SCGF fellowship is awarded to students based on academic performance and relevance of their proposed graduate research to the Office of Science mission. The GAANN fellowships are awarded by the institution to the students based not just on academic performance but also on financial need.

The GAANN fellowship requires a cost share by the academic institution. Because the DOE SCGF is awarded to the student, a cost share would not be appropriate or practical. The DOE SCGF fellowship awards do leverage the research awards and university support of the graduate student's academic advisor, which come from multiple federal and non-federal sources.

To meet the Department of Energy's mission and national goals for energy, environment, and scientific discovery and innovation, it is essential that the DOE support the training of the next generation of highly skilled scientists and engineers who will identify themselves with that mission. One of the ways we are accomplishing this is through a focused graduate fellowship program. The GAANN program is not capable of providing this level of focus to the DOE mission and these national goals.

HIGH-RISK, HIGH-REWARD RESEARCH

Mr. Pastor: The budget request notes that the Office of Science incorporates high-risk, high-reward research elements in all of your portfolios. Usually when we think of "high-risk, high-reward", we think of work with quantifiable benefits. Generally, the importance of your work has been in its application to our overall understanding of the universe, the result of which is somewhat difficult to quantify.

What do you mean when you speak of "high-risk, high-reward" research and development? Can you give us some examples?

Mr. Brinkman: The need for fundamental scientific and technological breakthroughs to accomplish DOE mission goals requires that the Office of Science, as well as ARPA-E, support high-risk, high-return research ideas that challenge current thinking yet are scientifically sound. However, the two programs' approaches to achieving high-risk, high-reward research are different. In general, the Office of Science focuses on basic science research whereas ARPA-E focuses on developing technologies.

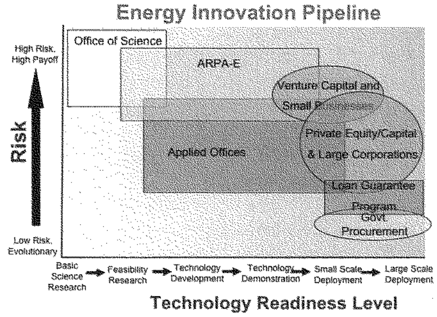
There are many ways to define "high-risk, high-reward research" and several organizations such as the National Science Board (http://www.nsf.gov/nsb/documents/2007/tr_report.pdf), the National Institutes of Health (http://nihroadmap.nih.gov/highrisk/), and the Defense Advanced Research Projects Agency (http://www.arpa.mil/body/pdf/DARPA2007StrategicPlanfinalMarch14.pdf) have all provided definitions in the context of their respective organizations. Since many factors can contribute to the high-risk aspect of a research proposal, by itself a definition of high-risk is not very meaningful. It is the high-reward aspect, the potential for high-payoffs, fundamental breakthroughs, paradigm shifts, impacts to a scientific field or new, enabling technologies that justifies the risk taking and is what is emphasized when the Office of Science refers to high-risk, high-reward research. A common element of the Office of Science's high-risk, high-reward research is the likelihood for the development of revolutions in understanding how nature works—from subatomic particles to atoms, molecules and whole systems—driven by transformational concepts and advanced scientific tools.

The scientific grand challenge research identified through the community workshops is one type of high-risk, high-reward research. The Basic Energy Sciences program uses the following working definition for grand challenge research: basic research to address fundamental limitations of current theories and descriptions of matter in the energy range important to everyday life, typically energies up to those required to break chemical bonds. Included in basic research are two types of research that seek fundamental new understandings: discovery research and use-inspired research. Discovery research targets fundamental new understandings on materials or systems that may revolutionize or transform today's energy technologies. In contrast, use-inspired research usually has the goal of addressing showstoppers on real-world applications in the energy technologies. Both are categories of basic research that have high-risk, high-reward elements to them and are supported within the core research areas of the Basic Energy Sciences program.

Mr. Pastor: How does this compare with the term when it is used by ARPA-E?

Mr. Majumdar: High-risk, high-reward research supported by ARPA-E is much more tightly coupled to a particular technology or technological application and generally much closer to commercialization. Furthermore, ARPA-E funds and supports small groups focused on breakthroughs in technology. It supports research on technology concepts that challenge conventional approaches and promise genuine transformation in the ways we generate, store, and utilize energy. ARPA-E uses a highly entrepreneurial funding model to support specific new technologies where a short-term R&D effort could deliver game-changing results. For example, an ARPA-E project is developing a technology to capture emissions from power plants that is inspired by the way the human body processes carbon dioxide.

Let me also explain through the figure below. The DOE Office of Science funds research in basic science and, at times, feasibility of a basic idea or a concept. Private capital is generally available at Technology Readiness Levels when products can be made based on a technology, and customers are ready to buy such products. So from the concept feasibility stage to the product development stage, there exists a big gap today (the so-called "valley of death") where many good ideas perish because the concepts cannot be translated into technologies. When these technologies are disruptive and could make today's approaches obsolete, this translation of ideas to technology is too risky both for the private sector and the applied energy offices in DOE. ARPA-E's goal is to invest in translating such ideas and concepts into disruptive technologies, and make them market ready. Furthermore, ARPA-E will invest in multiple disruptive technological approaches to reach the same goal (e.g., high energy density, low-cost batteries for plug-in hybrid vehicles), and then let the private sector choose the "winning" technology based on what is best for business. Hence, ARPA-E's goal is to reduce technological risks at various stages of developing disruptive technologies.



One additional way to understand ARPA-E's efforts is through an analogy to one of the great R&D efforts in history. ARPA-E aims to support visionary risk-takers launching new technologies, people like Bill Hewlett and David Packard, who operated out of their garage while pioneering new electronic products and jump-starting an entire new industry in what we now call Silicon Valley.

$40 MILLION FOR ADDITIONAL ENERGY FRONTIER RESEARCH CENTERS

Mr. Pastor: The President's budget request includes $40 million to establish new Energy Frontier Research Centers (EFRCs), in addition to $100 million to continue funding for EFRCs established in fiscal year 2009. These research centers constitute multi-year funding commitments, and the first batch of centers using new research model are only in their second year of operation.

Since it is too early to know if the EFRCs established last year are working, why is the Department requesting funding to establish new EFRCs?

Mr. Koonin: The Department is requesting additional FY 2011 research funding in the Basic Energy Sciences (BES) program to address priority research areas for the Department of Energy that have been identified through the recommendations of numerous scholarly studies: the discovery and development of new materials that are critical to science frontiers and technology innovations and basic energy research needs for carbon capture and for advanced nuclear energy systems.

The initial 46 EFRC awards resulted from the FY 2009 Funding Opportunity Announcement, which spanned a very wide range of energy research challenges described in the DOE *Basic Research Needs* series of workshop reports—allowing for maximum flexibility within intentionally broad guidelines. The distribution of the FY 2009 EFRC awards by topic area was predominantly determined by the scientific and technical quality of the proposals received. The Department was particularly interested in tapping the imagination and creativity of the scientific community to address the fundamental questions of how nature works and to harness this new knowledge for some of our most critical real-world energy challenges. Exceptionally strong proposals were funded in areas such as solar energy utilization, solid state lighting, energy storage, and catalysis. The specific research areas identified for increases in FY 2011 are underrepresented in the initial set of 46 EFRC awards.

The requested FY 2011 BES research increases for critical energy science frontiers and technology innovations support discovery and development of new materials and basic research for energy needs. Research for *Discovery and development of new materials* will focus on new synthesis capabilities, including bio-inspired approaches, to establish a strong foundation for science-driven materials discovery and synthesis in the U.S. This work will focus broadly on materials and will include crystalline materials. As described in the November 2009 NRC report *Frontiers in Crystalline Matter: From Discovery to Technology*, the U.S.—once the world leader in the discovery and growth of crystalline materials—has fallen behind other nations. Single crystals are vital in understanding the characteristics and properties of new materials, and they also have applications in devices that involve semiconductors, lasers, precision timing devices, solar cells, and high temperature operations, and provide a natural platform to explore novel states of matter.

Major areas of emphasis for *Basic research for energy needs* will be in fundamental sciences related to carbon capture and advanced nuclear energy systems. For carbon capture, focused areas include the rational design of novel materials and separation processes for post-combustion CO_2 capture, as well as catalysis and separation research for novel carbon capture schemes to aid the design of future power plants. For advanced nuclear energy systems, focused areas include radiation resistant materials in fission and fusion applications and separation science and heavy element chemistry for fuel cycles.

The indications from our initial EFRC Directors meetings are that the EFRC model is working well to link together groups of researchers across departments, schools, and institutions. Particularly encouraging are the reports from the EFRC Directors that students are enthusiastically self-assembling into teams around the EFRC model via Internet-based tools as well as more traditional collaboration methods. With many of the EFRCs led by (and all of them involving) universities, the EFRCs are becoming a powerful mechanism to better engage academic researchers on our Nation's major energy research priorities.

APPLIED INNOVATION AND COMMERICIALIZATION AT THE NATIONAL LABS

Mr. Pastor: The energy innovation hubs and energy frontier research centers (EFRCs) are in part in answer to the problems in the existing national laboratory system that prevent basic research discoveries from turning into energy-focused applications, and that prevent new innovations from reaching industry. The fact is, however, that more funding still goes to the national labs than to the hubs and EFRCs.

What are you doing to bridge the gap between basic and applied research, and to improve commercialization and technology transfer at the national laboratories?

Mr. Koonin: It is well known that private investment in long term fundamental research has declined substantially over the past three decades. The days of industry integrating basic and applied research in a proprietary setting are largely a thing of the past. In this landscape it is imperative that the Department step into this gap and, in so doing, promote industry awareness of and involvement with its R&D programs to accelerate innovation and commercialization of transformative energy technologies.

The Department's newer energy R&D initiatives—the Energy Frontier Research Centers, the Energy Innovation Hubs, and ARPA-E—are motivated in part by a recognition of the need to facilitate R&D team formation that is increasingly rare in the private sector. Roughly 45% of ARPA-E's first round project awardees included small businesses and is developing a commercialization team to assist its awardees. Proposers for Hubs commencing in FY 2010 are required to describe in detail how their management plan will promote industry involvement. The success of these programs will hinge in part on robust participation by industry to bridge the gap from the bench to commercialization.

The Administration is also committed to enhancing industry's access to DOE-supported research, both at the DOE laboratories and universities. The newly-appointed Technology Transfer Coordinator starts her tenure with a valuable base of broad stakeholder input that was collected through a November, 2008 Federal Register Request for Information. The Technology Transfer Coordinator's mandate is to start streamlining our technology transfer infrastructure—by reducing unnecessary delays and reducing transaction costs—in ways that will make the DOE complex a more transparent and responsive technology transfer partner for large and small companies, nonprofit R&D institutions, venture capital firms, and other potential investors. The Department is working to collect, disseminate, and promote adoption of current best-in-the-complex technology transfer practices. The laboratories have already begun discussing best practices through subcommittees of the Department's Technology Transfer Working Group, which is composed of representatives from each of the laboratories as well as DOE staff.

In addition to and in support of activities of the Technology Transfer Coordinator, the Department is enhancing and streamlining access to essential information needed to increase technology partnering opportunities between and amongst the industrial, venture capital, and laboratory communities. Within the next few weeks, the Department will launch a DOE Technology Transfer web presence to serve as a single point of access for information related to commercialization and technology transfer activities and opportunities available at each of the laboratories. Additional efforts that focus specifically on renewable energy and "cleantech" are also underway.

AMERICAN SCIENTIFIC LEADERSHIP IN SCIENCE

Mr. Pastor: The United States has had a long history of leading the world in science research and discovery. Today more than ever, however, we need to constantly reevaluate our global leadership position and carefully choose the direction for each of our major science endeavors in context of the global landscape. The Tevatron Collider at Fermi National Accelerator Laboratory (Fermilab) serves as a good example: the Tevatron is losing its position as the world's leading high-energy particle accelerator as CERN brings online the Large Hadron Collider in Europe. Fermilab and the Department's High Energy Physics program have moved quickly to reevaluate America's direction in this area, in order to identify where we can lead moving forward.

Across all of the Office of Science programs, where is the U.S. leading, and where are we not leading? In what Science programs should the U.S. be leading? What will it take to get there?

Mr. Koonin: With the strong support of Congress, the United States continues to hold a forefront position—and in many fields the undisputed lead—across the spectrum of the basic physical sciences.

As a result of strategic investments by the Office of Science over the past decade, the United States now holds an undisputed lead in civilian supercomputing and in the powerful new field of computational modeling and simulation. Just last November, the Cray Jaguar XT5 at Oak Ridge National Laboratory was named the fastest supercomputer in the world, and the Leadership Computing Facilities at Oak Ridge and Argonne national laboratories continue to support cutting-edge research in both science and industry. Thanks to funding under the Recovery Act, the United States is in the process of deploying, on a large prototype scale, the world's most capable broadband network.

The Office of Science supports the most powerful array of synchrotron light sources in the world. These have become premier tools across a range of fields, from materials science, chemistry, and biology, to research in nanoscience, much of it with major relevance to energy. The recently commissioned Linac Coherent Light Source at SLAC National Accelerator Laboratory is the world's first and only x-ray laser, with capabilities for capturing atomic-level phenomena on miniscule scales of space and time unmatched anywhere across the globe. The National Synchrotron Light Source II, now under construction at Brookhaven National Laboratory, is similarly expected to have capabilities far surpassing all other light sources in its general class. Work at four DOE national laboratory light sources played a role in research leading to the 2009 Nobel Prize in Chemistry.

The five DOE Nanoscale Research Centers provide American scientists with the most powerful array of tools in the world for research in nanoscience.

With the three DOE Bioenergy Research Centers (BRC), the United States also has an uncontested lead in research on bioenergy and biofuels, with breakthroughs that have already transcended the original conception of how cellulosic biofuels would be produced. New methods of pretreatment using room-temperature ionic liquids, reengineered microbes that can produce biodiesel directly from biomass, microbes retooled to produce hydrocarbon fuels—fungible substitutes for today's petroleum-based gasoline, diesel, and jet fuel—all these prospects and more have opened up, due to the BRC initiative. The DOE Office of Science, relying on its flagship Joint Genome Institute, has pioneered the field of genomics-based systems biology for energy, climate, and the environment, and supports a large community of scientists with unmatched expertise in these areas—leading the world in unlocking the secrets of the microbial and plant worlds for solutions to human problems.

In nuclear physics, the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory once again made headlines across the world this year with pathbreaking discoveries—the highest temperature ever achieved in a laboratory, corroborating evidence that RHIC has indeed recreated the quark-gluon plasma that existed only instants after the Big Bang, and the first detection of parity violation in relation to the strong force. These breakthroughs generated literally hundreds of articles across the globe, including coverage by television networks, cable news, and major newspapers and magazines in the United States. The 12 GeV CEBAF upgrade, now underway at Thomas Jefferson National Accelerator Facility, promises to give U.S. researchers the world's most powerful tool for understanding the structure of the nucleon, while the Facility for Rare Isotope Beams, planned for construction at Michigan State University, will give American scientists unmatched capability in the field of rare isotope research. Even now, American scientists are extending the Periodic Table of the Elements, participating in the recent discovery of element 117, enabled by using a target made of a rare isotope, Berkelium 249, which was produced in the High Flux Isotope Reactor at Oak Ridge National Laboratory. The biggest of "big science" today takes place as an international collaborative effort. In this spirit, hundreds of American scientists and engineers contributed to the construction of the Large Hadron Collider (LHC) at CERN, and hundreds continue to participate in LHC research, both at CERN and at U.S. universities and national laboratories via high-bandwidth networks supported by DOE and other agencies. The U.S. participation in LHC has been and continues to be critical to that facility's success. Neither the accelerator nor the detectors would have been possible to create without the expertise U.S. scientists and engineers brought to the project. U.S. scientists will share in the bounty of this international collaboration, and U.S. participation remains indispensable to maintaining a robust domestic workforce with capabilities and expertise in this most challenging field of science. With the planned shutdown of the Tevatron at Fermilab, America is planning to extend existing capabilities in its domestic high energy physics program to explore the still largely unmapped terrain of the neutrino, which could hold the key to some of the universe's deepest mysteries.

Today U.S. science is well-positioned across the full spectrum of the basic physical science disciplines. But just as the U.S. economy no longer dominates the globe as it did in the years immediately after World War II, so science also has become extremely competitive on an international basis. It is clear that continued U.S. leadership in science—and all the economic, energy, and security benefits that follow from it—will require continued effort and innovation and the commitment and resources to support a leading-edge program of research in the basic physical sciences, as well as their application to societies challenges.

RESEARCH PRIORITIES AND FUSION ENERGY SCIENCES

Mr. Pastor: You are reducing the budget request for fusion energy sciences by 11 percent, while increasing basic energy sciences by 12 percent. If Science is trying to establish knowledge that will inform groundbreaking developments in the medium to long-term, how does cutting funding for fusion science make sense?

Mr. Koonin: The reduction in overall funding for the Fusion Energy Sciences (FES) program is primarily due to the requested reduction in funding for ITER from $135 million in FY 2010 to $80 million in FY 2011. The requested amount is appropriate to the pace of the project. This level of investment will sustain the domestic ITER program's critical scientific research in support of the project and continue progress with its in-kind deliverables. The Office of Science is committed to ensuring that ITER is a success. The broader scientific fusion energy research activities supported by FES will not be impacted by the proposed reduction.

EVALUATION STUDIES

Mr. Pastor: Mr. Brinkman, you are requesting $5 million to initiate a research program to assess the effectiveness of investments in science. Would you explain what the objectives of this study are, and how they would be helpful in the Department's work? What's the total budget for this initiative? What are other agencies, such as the National Science Foundation, contributing, and for what years?

Mr. Brinkman: The Science of Science Policy (SoSP) funding will support research grants focused on investigating the types of tools, methods, and data for improving our understanding of the efficacy and impact of science and technology investments. The Office of Science has been a long-standing partner with the National Science Foundation (NSF) in gaining community input on research needs through open workshops. The Office of Science plans to coordinate activities with NSF, as well as pursue research opportunities that seek to address the unique needs of the Office of Science.

The total FY 2011 budget is $5 million for the Office of Science. The NSF's Science of Science and Innovation Policy Program has had a budget of $8-10 million per year for this activity for the past four years. No other agency has a dedicated budget for this activity.

The Department of Energy is a co-chair, along with NSF, of the SoSP Interagency Task Group, chartered by the White House National Science and Technology Council's Committee on Science. The SoSP Interagency Task Group, which has members from 17 science and technology agencies, produced the "The Science of Science Policy: A Research Roadmap," in November 2008 and held a public workshop on the Roadmap in December 2008. That Roadmap and workshop identified the need to develop a data infrastructure and new analytical tools, such as models and visualization techniques, which will enable policy makers to assess the benefits and effectiveness of Federal science and technology investments.

The Task Group also sponsored an October 2009 workshop focused on Federal agency best practices in the research portfolio evaluation and prioritization.

The SoSP Roadmap can be accessed at the following website: http://www.scienceofsciencepolicy.net/blogs/sosp/pages/sosproadmap.aspx

The Roadmap is also attached as a .pdf.

COMMITTEES OF VISITORS REVIEWS

Mr. Pastor: So-called "Committees of Visitors" review your program portfolios every three years in order to assess their balance and impact. Which programs were evaluated last year, and which will be evaluated this year? How are these evaluations used in developing your budget request?

Mr. Koonin: During the previous twelve months (April 2009 to March 2010), four Committees of Visitors (COVs) performed evaluations. The programs evaluated during that time frame are the Computer Science subprogram within the Advanced Scientific Computing Research (ASCR) program, with a COV held June 30–July 2, 2009 and the report published October 20, 2009; the Materials Sciences and Engineering subprogram within the Basic Energy Sciences (BES) program, with a COV held March 31–April 2, 2009 and the report published July 9, 2009; the Fusion Energy Sciences (FES) program, with a COV held August 17-19, 2009 and the report published on April 2, 2010; and the Nuclear Physics (NP) program, with a COV held January 12-14, 2010 and a report published April 2, 2010.

Over the next 12 months (April 2010 to March 2011), the following five COV evaluations are planned: The ASCR Applied Mathematics subprogram to be held May 12-13, 2010; the BES Scientific User Facilities subprogram to be held April 6-8, 2010; the BER Climate and Environmental Science subprogram to be held July 20-22, 2010; the High Energy Physics (HEP) program to be held October 13-15, 2010; and, the Workforce Development for Teachers and Scientists (WDTS) program to be held May 18-19, 2010.

The Office of Science COVs, subcommittees of the Office of Science Federal Advisory Committees, are asked to assess the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document funding actions and to assess the quality of the resulting portfolio. The COVs are also asked to evaluate the national and international standing of the elements and the breadth and depth of the portfolio. The Office of Science has been holding COVs since 2002. Part or all of each funding program is reviewed every three years. All of the resulting reports, published by the Federal Advisory Committees, are posted on our website at http://www.science.doe.gov/SC-2/Committee_of_Visitors.htm.

The COV reports are used to help us improve our program management practices. The committees inform us of what is working well and what practices need improvement. For example, many of our subprograms have implemented improved documentation and recordkeeping in response to the earliest COV recommendations. The COV reports can also impact our investment areas. For example, after receiving recommendations from many COVs that we should fund more investigators early in their careers, the Office of Science recently implemented the Early Career Research Program as a subset of its core research funding. Another way COVs can influence the budget request is through the recommendation that workshops be held in areas of emerging need, and such workshops can influence our budget request for pursuing special solicitations and initiatives. For example, the 2005 BES COV recommended continued support for the Basic Research Needs workshop series, which eventually led to a budget request for the Energy Frontier Research Centers. The COV evaluations can also result in gradual shifts of subprogram emphasis from funding one science theme toward funding another. For example, the chemical engineering core research area was combined with others and shifted in emphasis as a result of the first BES COV report published in 2002. Finally, our COVs identifies_the federal staffing and program manager travel and professional development needs in the subprograms, which helps the Office of Science formulate its Program Direction budget request.

Mr. Pastor: Please submit for the record all Committees of Visitors reviews that have been completed in the last 18 months.

Mr. Koonin: I would like to submit for the record five COV reports. These are COV reviews that have been completed within the last 18 months (October 2008 to April 2010). All COV reports and program responses are posted on our COV website as soon as they become available.

NP_COV_2010_Report.pdf
ASCR_COV_2009_CS_Report.pdf
BER_COV_2008_LMSD_Report.pdf
BES_COV_2009_DMSE_Report.pdf
FES_COV_2010_Report.pdf

SUPPORT SERVICES

Mr. Pastor: Mr. Brinkman, your budget request includes a $7.3 million increase for Support Services, $4.5 million of which is apparently to sustain a constant level of effort for these activities. Your fiscal year 2010 budget was $16 million.

Why do you need to increase funding by 25% just to maintain a constant level of service?

Mr. Brinkman: The FY 2010 appropriation provided Science Program Direction a 1.4% increase over the FY 2009 appropriation. Within this 1.4% increase, the January 2010 pay raise of 2.0% and pay-related escalation of 5.1% had to be accommodated, which created a shortfall in the rest of the program. To fully fund salaries and benefits, budget authority for support services was reduced by 32% from FY 2009. However, we were able to maintain about the same level of support services operations in FY 2010 by using $6.7 million of prior year balances. These prior year balances will be depleted at the end of the fiscal year. The $7.3 million increase in FY 2011 reflects $6.7 million for activities funded in FY 2010 using prior year balances, $0.4 million for workforce training, and $0.2 million for escalation. Support service funding is $0.2 million below the FY 2009 level.

INFRASTRUCTURE MODERNIZATION

Mr. Pastor: The Office of Science began an Infrastructure Modernization program in fiscal year 2009 in order to provide necessary laboratory infrastructure over ten years. How does the budget before us support that plan? Your request for Science Laboratory Infrastructure is slightly cut from last year's level. Is this consistent with investments needed over the plan's timeframe?

Mr. Brinkman: The 2011 request accounts for the completion of funding for the Interdisciplinary Science Building project in 2010, and allows for needed increases in remaining ongoing projects as well as the initiation of two new projects. The net effect is a small reduction in the 2011 request relative to the 2010 appropriation. The request permits the continuing execution of a portfolio of construction projects that will modernize the Office of Science laboratory facilities and utility systems, ensuring they are mission-ready and can fully support scientific discovery. Altogether, seven projects have started design or are in construction under the infrastructure modernization effort.

Mr. Pastor: Please submit for the record the Infrastructure Modernization plan, by site and required investment, for the initiative's timeframe.

Mr. Brinkman: Plans for infrastructure modernization plan are revisited annually to ensure the projects and priorities continue to best support Science missions. In addition, project scope and costs are refined and updated as each project moves toward establishing a performance baseline. The FY 2011 President's Request includes funding for those projects that are the highest priority. The request also includes details on the cost and schedule of those projects that have established baselines.

UTILIZATION OF USER FACILITIES

Mr. Pastor: Given the cost of constructing cutting-edge scientific user facilities and the demand for these facilities by scientists across the country and the globe, it makes sense to use these facilities as optimally as possible once they begin operation. The budget request includes increases for the operation of many user facilities to increase their utilization. How optimally are the Office of Science facilities being used currently, and how close to optimal utilization will they be at the levels of funding in the budget request?

Mr. Koonin: Overall, under the FY 2011 request, Office of Science User facilities would operate at 95% of optimal levels, about even with the 96% of optimal anticipated under the FY 2010 appropriation. Advanced Scientific Computing Research, Biological and Environmental Research, and High Energy Physics facilities are all planned to operate at 100% of optimal levels in FY 2011. All Basic Energy Science facilities, save the Linac Coherent Light Source also are planned to have operations at optimal levels. The Linac Coherent Light Source is planned for 80% of optimal operations in FY 2011, as we ramp up its user program during its first full year of operations. The four Nuclear Physics facilities are planned for operations at an average of 83% of optimal, primarily due to planned down time at the Continuous Electron Beam Accelerator Facility to accommodate installation of components for the on-going upgrade project to double the beam energy to 12 billion electron-volts (GeV). Fusion Energy facilities operate at 57% of optimal levels. For FES, this limited operation is due primarily to two factors. The first is the planned outage of the DIII-D facility for the first half of the fiscal year to complete a major upgrade. The second is the need to maintain within the funding available a reasonable balance between operating time and modest upgrades to the NSTX and Alcator C-Mod facilities. In order to continue to maintain the capability to carry out world class research on these two facilities, it is necessary to regularly make diagnostic and facility upgrades.

TOTAL PROJECT FUNDING

Mr. Pastor: Your Construction Projects detailed justification lists the total funding required for each project, usually within a range. It has the funding already provided, and the funding requested this year. Within the "Outyears" column for most projects, however, there are three letters…"TBD".

Why can you not tell us how much more money you will need for each of these projects, if you can tell us what the total will be and we know what has already been provided and requested?

Mr. Koonin: For Science Laboratory Infrastructure projects that have not yet established a performance baseline, "TBD" or "To be Determined" was placed in the outyear column. As a general rule, SLI outyear plans are based on the conservative assumption that each project will establish a baseline at the upper end of the stated cost range. Therefore, this number can be used to estimate outyear funding requirements until the performance baselines are established.

PROCESS MANAGEMENT OF CONSTRUCTION PROJECTS

Mr. Pastor: The Office of Science has recently done a better job keeping construction projects at their original cost estimates. However, I understand that this often is done by reducing the scope of projects—in other words, as project costs escalate, the scope of the project shrinks so that total cost can remain within the original estimate. When project managers take this approach, people might forget that the original cost estimate was wrong.

Have you heard of this "de-scoping" approach to Office of Science construction projects?

Mr. Brinkman: The Office of Science does not "de-scope" projects to maintain the original cost baseline. SC plans most projects with what is known as the objective value (or the desired performance) and the threshold value (the more conservative and minimum acceptable scope performance an asset must achieve), which are stated in the Project Data Sheet and other budget documents. The objectives and thresholds form the boundary condition within which the project manages to completion—striving to meet the objectives, but achieving at least the minimum thresholds.

SC believes that clearly defining and planning for the Objective and Threshold Values is a good project management practice that is consistent with DOE requirements and processes. SC does not define a project as a success unless the project cost, the project completion date, and the threshold value for the project scope are achieved.

Mr. Pastor: How prevalent is this approach? Do you support its use? How has the Department improved its cost estimates and construction process management?

Mr. Brinkman: Office of Science has a good history of project success. Some of the best practices that SC utilizes, such as peer review, are being implemented for other DOE programs. The peer review practice was promoted by the Office of Science and Technology Policy as a best practice for all Federal agencies. There are always opportunities for improvement. As such, the Department is in the process of developing and establishing new tools, procedures, and organizations in an attempt to improve its cost estimates and construction process management.

Mr. Pastor: How does the Department plan to improve its construction management processes moving forward to improve its original cost estimating?

Mr. Brinkman: Improving project management is one of the highest priorities for the Secretary of Energy. All senior managers, the Deputy Secretary, the Under Secretaries, Program Directors, and Secretary Chu, are actively participating in meetings to discuss project issues, challenges, and corrective measures. The Secretary is requiring all senior managers to be proactive and accountable for the successful execution and completion of projects under their authority.

In addition, there are several efforts being initiated, including updating DOE policies and procedures on project management, restructuring of large multi-billion dollar projects into smaller more manageable projects with shorter construction duration, and the use of peer review throughout DOE.

INTERDISCIPLINARY SCIENCE BUILDING AT BNL

Mr. Pastor: The Interdisciplinary Science Building at Brookhaven National Laboratory (BNL) received $39 million in the FY10 budget and $18.6 million in the stimulus Act. Nothing, however, is in the FY11 budget request for this project. Why not? How much funding will be carried over into FY11?

Mr. Koonin: This project is fully funded as of FY 2010. The project recently established a performance baseline and has started site preparation activities. The building construction contract is scheduled to be awarded in the fourth quarter of this fiscal year, which will obligate the majority of remaining project funds to the successful contractor. Once that contractor is on board, they will lay out a detailed plan for executing the project, which will allow us to forecast the costing schedule. Because this project is fully funded, that contractor will be able to execute the work in the most efficient way possible.

FERMILAB UTILITIES UPGRADE

Mr. Pastor: Mr. Brinkman, your budget requests $3 million for beginning construction on the Utilities Upgrade project at Fermilab, in addition to $4.4 million for Project Engineering and Design. If Fermilab is going to fulfill its proposed role in the complex's future, this program is important. In your project management process, you've approved mission need and developed the cost range, but you've not yet approved the performance baseline or approved start of construction.

Why are you requesting construction funds so early in the process, especially before you've reached the point of approving the start of construction?

Mr. Brinkman: This project is straightforward, and design will be completed well within the 18-month time frame allowed by DOE's project management guidelines for requesting construction funds. In addition, the nature of this project will allow the contractor to initiate discrete elements of work in the field as design matures. As a result, upfront dedication of funds for this particular project reduces risk because it allows construction to proceed most efficiently.

Mr. Pastor: What percentage of a design is generally completed before you commence any construction?

Mr. Brinkman: Construction for a specific scope of work is generally started upon completion of 100% design for that scope of work. Tailoring of the project's critical decisions, however, can allow work to start on scope elements that are fully designed while other design work matures. For a multi-faceted project such as the Fermilab utilities project, portions of work scope will be designed and ready to start construction in 2011. Given the importance of this project to the site's Science mission, it is critical that we take an efficient approach to completing the project.

Mr. Pastor: How does this percentage vary, if at all, based on the complexity of the project?

Mr. Brinkman: Discrete elements of work are initiated at 100% design, and that typically does not vary except where design-build procurements are used. However, tailoring of the project and its critical decisions often permit some elements of work to proceed while remaining design work continues to mature. The overall tailoring approach for a given project will vary based on complexity of the project and the risk caused by starting some work elements (such as site preparation) prior to completing the entire design.

SLAC BUILDING PROJECT AND CONTINGENCY DETERMINATION

Mr. Pastor: Mr. Brinkman, the SLAC Research Support Building and Infrastructure Modernization project seems to be pretty straightforward: you need to build a new office building and renovate two other buildings.

Why would this project need a 20% contingency built into it?

Mr. Brinkman: Office of Science standard practice is to include a minimum of 20% cost contingency on all projects when we initially establish a performance baseline. This is just one of the ways that we manage risk on our projects to ensure on-cost, on-schedule completion. A higher percentage is often used on larger, more complex projects.

The SLAC project is multi-phased, including renovation of two buildings. In renovation, hidden conditions bring uncertainty and risk to the project, such as the potential to find hazardous materials or structural deficiencies upon removing the finishes. Maintaining cost contingency reduces the risk that these unforeseen conditions will cause the project to exceed its cost baseline.

Mr. Pastor: How do you determine your contingency percentages?

Mr. Brinkman: SLI practice is to establish a minimum of 20% cost contingency on all projects when they initially establish a performance baseline. That benchmark is standard practice across the Office of Science, although a higher percentage is often used on larger, more complex projects. As projects move into construction, risk is managed over the life of the project through a Risk Management Plan. When identified risks are "retired," designated contingency funds are released and applied to project scope.

Mr. Pastor: Has the Office down a retrospective evaluation of the accuracy of its contingency determination process?

Mr. Brinkman: In 2008, SLI program managers conducted an evaluation of the 20% cost contingency benchmark. The study looked at infrastructure projects typical under SLI, and those not involving complex scientific apparatus. The results of the study indicated that this amount of contingency was adequate, as evidenced by the fact that the projects stayed within their cost baseline.

Mr. Pastor: You have not reached CD-2 (Approve Performance Baseline) or CD-3 (Approve Start of Construction). The schedule in your budget request lists that you'll be able to approve start of construction in the fourth quarter of this year.

Do you still expect to be able to do so?

Mr. Brinkman: No, the schedule submitted with the 2011 President's Request was preliminary and has been revised slightly. According to the updated schedule, approval to start construction is forecast for the first quarter of 2011.

Mr. Pastor: If not, how will that affect your budget request of $30.2 million for construction in FY2011?

Mr. Brinkman: This will not affect the budget request. Requested funds will be obligated to the successful contract bidder in the first quarter and construction will proceed.

BROOKHAVEN NATIONAL LABORATORY LABORATORIES RENOVATION PHASE II

Mr. Pastor: Mr. Brinkman, you are requesting $13 million in construction funds to renovate science labs at Brookhaven. However, you will not approve the start of construction until the end of the year.

Why would you need so much money if construction can't start until the end of the year?

Mr. Brinkman: This project has not yet established a performance baseline, and the schedule provided in the 2011 President's Request is preliminary. The initial schedule provided ample time for upfront planning and design due to the complex phasing and personnel moves that are required for this project. As the design matures, the project team will evaluate the schedule and assess the possibility of proceeding to construction more quickly.

It is also very important to note that SLI projects are granted approval to begin construction only when construction bids are "in hand." Therefore, when you see a forecasted CD-3 date that is the point in time at which we are ready to award the construction contract, immediately obligate funds to the contractor, and begin field work. We believe this approach reduces overall project risk and helps ensure successful completion of projects on cost and on schedule. For projects like this one, which has added complexity due to planned personnel moves, timing is important, and ensuring funds are available when needed also reduces risk to the project.

Mr. Pastor: What if CD-3 approval slips into FY2012? How would that affect your budget request?

Mr. Brinkman: We have high confidence that the current schedule will not slip. In the event of a minor schedule slippage, however FY 2011 construction funding would remain available for obligation early in FY 2012.

LAWRENCE BERKELEY NATIONAL LABORATORY SEISMIC LIFE-SAFETY, MODERNIZATION, AND REPLACEMENT OF GENERAL PURPOSE BUILDINGS

Mr. Pastor: Congress has provided nearly $64 million for the Lawrence Berkeley National Laboratory infrastructure project since fiscal year 2008. While you have obligated all of this funding, you're carrying an uncosted balance of $40.4 million.

Why are you carrying so much money forward?

Mr. Brinkman: The Acquisition Executive has recently approved the start of construction for a large element of work on this project, and the project overall is performing according to its performance baseline.

Mr. Pastor: What are you doing to speed up implementation of these funds?

Mr. Brinkman: Project tailoring has been implemented so that the Acquisition Executive may approve construction of work elements to proceed as soon as those portions of the design are completed. The Recovery Act portion of work has been approved to start construction, and the project is proceeding according to the established performance baseline. We are confident that the project will continue this successful performance.

FULL COST RECOVERY

Mr. Pastor: Mr. Brinkman, your budget requests notes that for the first time, your office is proposing to recover nearly $8.2 million from direct charges for your safeguards and security services. Your budget request states that it will support "the current level of effort" for sites.

Are these services that were funded through appropriations in previous years?

Mr. Brinkman: Prior to FY 2009, a portion of safeguards and security expenses associated with work for others were recovered through charges to reimbursable customers at the SC laboratories. In FY 2009 and 2010, all funding associated with safeguards and security charges for work for others at SC laboratories was requested through direct appropriations.

Mr. Pastor: If so, why does your budget request increase by $3.5 million instead of falling by the amount you're recovering from customers? Please keep in mind that your materials state that the request will fund the current level of effort for sites.

Mr. Brinkman: Although SC is fully supportive of the work for others program, funding security associated with work for others directly has resulted in decrements to safeguards and security operations that have proven difficult to predict. Up to now, these cumulative costs have been addressed by deferring pre-planned maintenance and upgrades to critical security systems and infrastructure in order to maintain the necessary level of protection that included the additional work for others burden. The deferral of maintenance and infrastructure has occurred at the same time that Science and work for others missions have been steadily increasing at our laboratories.

Funding work for others while maintaining a consistent level of security effort under a fixed budget is no longer tenable and as a result, work for others will again be directly charged to the beneficiary agency. Charging this separately will permit the current direct budget request to cover recurring security costs for the core science mission and provide for needed systems maintenance and repairs.

PROGRAM DIRECTION AND THE RECOVERY ACT

Mr. Pastor: The budget request for Program Direction is at $25 million over last year, a 13 percent increase. Of this increase, $15 million is for salaries and benefits intended to support 58 new hires.

How many of these new hires would support work currently funded by the Recovery Act?

Mr. Koonin: The Office of Science did not hire any Federal staff to support work funded by the Recovery Act. The Office of Science used contract funding to hire temporary contractor support to perform the work funded by the Recovery Act.

Mr. Pastor: How many current full-time employees have been brought on or transferred over to support Recovery Act work?

Mr. Koonin: The Office of Science did not hire any Federal employees to support Recovery Act work. Current onboard staff worked on the Recovery Act in addition to their normal workload.

Mr. Pastor: What's the Department's transition plan for these employees?

Mr. Koonin: A transition plan is not needed because there are no Federal employees dedicated to just Recovery Act work.

NEW HIRES

Mr. Pastor: The budget request increases funding for program direction to support 58 new hires. Your budget request states that many Committee of Visitors reports have highlighted staffing concerns. Please explain to the subcommittee how the staffing increases in your budget request specifically and directly address those concerns.

Mr. Koonin: Since FY 2002, 17 COV reports have identified federal staffing and travel funding shortages within the SC research program offices. Some reports have noted that staff levels are insufficient for adequate review, oversight, and management of the research programs.

In direct response to the many COV report recommendations relating to staffing shortfalls within the Headquarters research program offices, the FY 2011 President's Request provides 22 additional Headquarters Program Managers to provide management and oversight of a significantly increased SC research portfolio across a broad spectrum of scientific disciplines and program offices. These 22 additional Headquarters Program Managers, in combination with new Program Managers to be hired in FY 2010, will provide a 26% reduction in the size of the average research portfolio currently managed by a Headquarters Program Manager, reducing the workload to a more manageable level.

To ensure adequate infrastructure is in place to carry out the implementation and execution of the Headquarters developed and directed scientific program, the FY 2011 President's Request also provides 36 additional staff across the SC field complex in acquisition, financial, human resources, legal, health, safety, security, facilities management, and other necessary infrastructure areas to ensure the oversight and management of the 10 Management and Operating contracts that SC has responsibility for and grants management. The increased SC research and construction funding since FY 2008 has created a significant workload in the acquisition, safety, security, project management, and facilities management areas in particular. Prior to FY 2011, SCPD budgets and workforce have not kept pace with the total SC budget increases. From FY 2006 to FY 2010, total SC funding grew at an annualized growth rate of 7.8%; in contrast, SCPD funding only increased at an annualized rate of 4.4% for the same timeframe.

Mr. Pastor: How many program managers does Science currently have, and what is the average portfolio size for each of those managers? How does this compare to the rest of the Department, and other similar agencies such as the National Science Foundation?

Mr. Koonin: As of March 2010, there are 108 Headquarters Program Managers on board and the average portfolio managed by each is approximately $42 million. The FY 2011 President's Request will reduce the average portfolio managed by each program manager to around $31 million. The Office of Science completed a study which benchmarked SC extramural research (research performed by non-federal staff) funding and program direction budgets for the FY 2007, FY 2008 and FY 2009 appropriations and FY 2010 President's Request fiscal years against the National Institute of Health's (NIH) National Cancer Institute (NCI) and National Institute of Allergy and Infectious Diseases (NIAID), since both conduct extramural fundamental research and are comparable in budget to the Office of Science. The study used publically available data such as Congressional justifications, mechanism tables, and other information accessible to the public via the internet. The study did not benchmark the Office of Science against the National Science Foundation.

The study found that SC extramural research funding has increased almost 27 percent from FY 2007 to FY 2010, while NCI and NIAID's comparable research levels increased about 7 and 10 percent respectively; SC's FTEs averaged slightly higher (7%) than NIAID from FY 2007 to FY 2010; NCI's averaged over 17% higher than SC; In all fiscal years, SC's research funding per FTE is similar to NIAID's and both are higher than NCI's, with SC's research funding per FTE increasing over 9 percent from FY 2007 to FY 2010, while NCI's increased 3% over the same time period. The SC Program Direction per FTE average over the FY 2007-FY 2010 timeframe is 47% less than NCI and almost 13% less than NIAID; and SC's grants and contract awards increased almost 23% from FY 2007 to FY 2009, while NCI's awards decreased slightly and NIAID's awards increased slightly.

BALANCING INFRASTRUCTURE AND RESEARCH FUNDING

Mr. Pastor: The Recovery Act provided $1.6 billion for the Office of Science, and the Department was given discretion to determine how the funding would be split between infrastructure projects and research activities.

How much of the Office of Science's Recovery Act funding was allocated to infrastructure projects?

Mr. Brinkman: The Office of Science (SC) received $1.6 billion in Recovery Act funding to be used according to the goals of this initiative. A total of $1.03 billion is being used to fund SC infrastructure projects. Examples of infrastructure projects include the National Synchrotron Light Source II to accelerate the execution of the civil construction and advance the procurements of Accelerator System Components; the Advanced Light Source User Support Building at Lawrence Berkeley National Laboratory to accelerate construction and pre-purchase of materials; a one-time capital equipment initiative at Environmental Molecular Sciences Laboratory, for facility modifications to accommodate instrument upgrades at Pacific Northwest National Laboratory; Superconducting Radio Frequency development of required infrastructure at Fermilab in support of the development of U.S. industrial SRF capability; accelerated construction of a new materials and chemical sciences research facility at Oak Ridge National Laboratory; renovation of laboratory space at Lawrence Berkeley National Laboratory; construction of a new interdisciplinary science building at Brookhaven National Laboratory; and demolition of the aging Bevatron complex at LBNL, which will provide buildable space at the laboratory for future program needs.

Mr. Pastor: How did the Department determine this split between infrastructure projects and projects for other purposes?

Mr. Brinkman: In determining the projects to be supported by Recovery Act funds, SC focused on two of the main objectives of the Act: "to preserve and create jobs and promote economic recovery" and "to provide investments needed to increase economic efficiency by spurring technological advances in science and health". As a result, SC selected projects to achieve maximum short-term economic and jobs impact, while bolstering the Nation's long-term scientific strength.

The projects selected fall under five key themes specific to the Office of Science: accelerate construction of key scientific facilities; acquisition of advanced scientific instrumentation; upgrades and modernization of our national laboratory infrastructure; expanded research support for graduate students, postdocs, and Ph.D. scientists; and solving critical research problems in areas such as high energy and nuclear physics, biofuels, solar energy, solid-state lighting, superconductivity, electrical transmission and storage, carbon sequestration, combustion, environmental clean-up, and materials science for energy efficiency.

In addition, the SC Recovery Act projects selected fulfilled specific characteristics such as being "shovel-ready," available to enhance research infrastructure and support high-priority R&D, present low risk (e.g., construction projects were baselined and research projects had proposals in hand or solicitations were to be fast) and for the most part did not generate outyear mortgages.

There are two exceptions in terms of outyear mortgage: Energy Frontier Research Centers and Graduate Fellowship/Early Career Awards. As a result of these criteria, SC selected fifty-one projects using Recovery Act funding.

MAXIMIZING SCIENTIFIC BENEFIT OF RECOVERY ACT FUNDING

Mr. Pastor: I understand that a large proportion of the Recovery Act funding for the Office of Science has been and will be spent on facilities. This is necessary, given the major need to upgrade and expand the aging facilities at the Office of Science. But what is your strategic plan to maximize the total scientific benefit of Recovery Act funding?

What mechanisms have you put in place to ensure adherence to the strategic plan?

Mr. Brinkman: Once Recovery Act projects were determined, program offices developed short two page descriptions of the projects, project milestones, and project operation plans to outline the specifics of each project, including obligation and cost timeline, overall strategy and contingency plans. These documents were reviewed and approved by DOE management before any funding was released. These documents form the baseline from which progress continues to be measured on an ongoing basis and provide tools to identify projects that are not performing according to plan.

In addition, SC worked closely with field and site offices to review the Recovery Act funding requirements and develop methods to efficiently address them. Work authorization statements and guidance letters, which detail funding and reporting requirements for a specific contract, were updated to reflect Recovery Act specific funding and reporting guidance. Also, Section H clauses, which are special contract requirements developed for use, as needed, in specific contracts warranting additional guidance, were implemented for all projects receiving Recovery Act funding. To ensure that Recovery Act funding is being expended according to the approved plans and guidance, increased management scrutiny has been implemented as part of the review process, including, but not limited to, the implementation of monthly reports to track recovery-funded transactions at all levels of granularity.

ACCELERATING CONSTRUCTION PROJECTS WITH RECOVERY ACT FUNDING

Mr. Pastor: Recovery Act funding accelerated construction projects at Office of Science facilities, which will bring scientific facilities online earlier and allows scientists to begin research at these facilities earlier than originally planned.

What does this infrastructure investment buy us—how much has it accelerated these construction projects, what science research have we accelerated, and by how much?

Mr. Brinkman: Recovery Act funding is helping to accelerate the Infrastructure Modernization Initiative, and will result in quicker delivery of modern, safe and environmentally-friendly laboratories that will be used to facilitate break-through discoveries in clean energy technologies for America's future.

The Recovery Act funding was authorized shortly after construction started on the NSLS-II project at Brookhaven National Laboratory. This allowed the project to eliminate budget driven schedule delays and optimize the baseline schedule for several project elements, which enabled a 4 month acceleration of the early finish date.

We expect the Modernization of Laboratory Facilities project at Oak Ridge National Laboratory to complete seven months ahead of schedule, providing modern 21st century laboratory space for energy-related materials and chemical science that much sooner. We estimate that the Interdisciplinary Science Building, Phase I project at Brookhaven National Laboratory will be completed three months ahead of schedule, providing high-accuracy laboratory space sooner for synthesis and characterization of materials for energy-related research and development. The Seismic, Phase II project at LBNL corrects seismic safety deficiencies and provides safe, modern, and efficient facilities for multidisciplinary biology. Recovery Act funding will help accelerate the completion of building 74 renovations by approximately six months.

CANCELLATION OF FAILING PROJECTS

Mr. Majumdar, you have indicated that ARPA-E intends to constantly evaluate each award and pull funding for failing projects. This seems like a great idea, but it's something we see too infrequently in government settings.

How will you know whether a project is failing?

Mr. Majumdar: Upon selection of a recipient for award, we work with the recipient to establish a set of technical milestones and deliverables for each quarter and year. ARPA-E focuses on high-risk, high-reward energy technology development, so our technical milestones and deliverables are very aggressive. We incorporate these technical milestones and deliverables into our funding agreements with the recipients. We closely monitor the recipients' progress throughout the year. The Program Director will conduct at least two site visits for each of the projects in his/her program, where he/she will visit the laboratory to monitor the recipients' progress and assess whether they have met their technical milestones and deliverables, and if not, why they have not met these milestones and deliverables. These milestones and deliverables are an objective yardstick for measuring the recipients' technical progress each quarter. If, after a quarterly review, ARPA-E determines that the recipient has failed to meet milestones, schedule, or cost commitments, ARPA-E may at its discretion 1) renegotiate these terms/conditions and continue funding, or 2) discontinue funding under this agreement. In addition to the site visits, the Program Director will conduct a comprehensive program review once a year, where each project in the program will be reviewed in depth. The technical milestones and deliverables are used during these meetings to determine whether the project is meeting its stated objectives, and whether we should maintain funding for the project.

Will you set milestones for each project which, if not met, will lead to cancellation of the project?

Mr. Majumdar: As discussed above, we work with each recipient to establish a set of technical milestones and deliverables for each quarter and year. We meet with each recipient during site visits twice per year and on an annual basis during the program review to assess whether the recipient has met his/her technical milestones and deliverables and if not, why not. We will not hesitate to discontinue projects that are not making progress. ARPA-E focuses on high-risk, high-reward energy technology development, so we expect a substantial percentage of our projects to fail. However, decisions to discontinue funding will be made on a case-by-case basis.

When will these milestones be set, and will they be made public for each project?

Mr. Majumdar: As discussed above, upon selection of a recipient for award, we work with the recipient to establish a set of technical milestones and deliverables for each quarter and year. ARPA-E focuses on high-risk, high-reward energy technology development, so our technical milestones and deliverables are very aggressive. We incorporate these technical milestones and deliverables into our funding agreements with the recipients. ARPA-E has made detailed information on the 37 projects that we are funding publicly available on the website.

ARPA-E has not published the technical milestones and cooperative agreements. These technical milestones and deliverables often contain trade secret, privileged, or proprietary information that, if disclosed, could threaten the integrity of the projects and the success of these business ventures. Further, public disclosure of the technical milestones and deliverables may put at risk intellectual property that was developed with private or public funds, enabling competitors to steal the funding recipients' technologies.

What process will ARPA-E use to cancel a failing project?

Mr. Majumdar: Upon selection of a recipient for award, we work with the recipient to establish a set of technical milestones and deliverables for each quarter and year. ARPA-E focuses on high-risk, high-reward energy technology development, so our technical milestones and deliverables are very aggressive. We incorporate these technical milestones and deliverables into our funding agreements with the recipients. We closely monitor the recipients' progress throughout the year. Every quarter, we meet with the recipient to assess whether he/she has met the technical milestones and deliverables, and if not, why he/she has not met these milestones and deliverables. These milestones and deliverables are an objective yardstick for measuring the recipients' technical progress each quarter. If, after a quarterly review, ARPA-E determines that the recipient has failed to meet milestones, schedule, or cost commitments, ARPA-E may at its discretion 1) renegotiate these terms/conditions and continue funding, or 2) discontinue funding under this agreement. In addition to quarterly progress reports, we conduct comprehensive reviews of each project approximately once per year. The technical milestones and deliverables are used during these meetings to determine whether the project is meeting its stated objectives, and whether we should maintain funding for the project.

Is the possibility of cancellation written into contracts with each grant recipient?

Mr. Majumdar: Every ARPA-E funding agreement requires comprehensive project reviews approximately once per year. The purpose of this review is to make a go/no-go determination, i.e., whether we should continue funding for a particular project. Thus, every funding agreement incorporates a mechanism for the decision points regarding the continuation of funding at specific points in the award period.

MEASURING THE OVERALL SUCCESS OF ARPA-E

Mr. Majumdar, ARPA-E aims to invest in high-risk but game-changing technologies, and the Department has said it does not expect every project to succeed. This model almost emulates a venture capital investor, who might, for example, invest in twenty companies and expect only a small handful to succeed. In a time of limited government funding, we only want to fund successful endeavors, and this raises the question of exactly what ARPA-E considers success.

What is a "successful project"?

Mr. Majumdar: First, ARPA-E will fund those ideas that are too risky for the private sector to invest. These risks include both technology and market risks. Furthermore, ARPA-E will fund multiple competitive and parallel approaches to reach the same performance and cost target of technology, and after the technology is de-risked, then let the private sector pick the ones that are best for business. The results are technology options for the Nation and some element of internal competition within the Nation, both of which are very important for innovation and U.S. technological lead in the world. This is a very different model than the venture capital investment. Upon selection of a recipient for award, we work with the recipient to establish a set of technical milestones and deliverables for each quarter and year. ARPA-E focuses on high-risk, high-reward energy technology development, so our technical milestones and deliverables are very aggressive. A successful project is one that meets the technical milestones and deliverables over the course of the award period. We set the bar high and build into our funding agreements milestones and deliverables that, if met, would not only overcome a specific technical barrier, but also allow a technology to attract future private investment and make progress towards the market.

Does ARPA-E consider an interesting innovation a success, or only a game-changing innovation that actually gets adopted in the marketplace?

Mr. Majumdar: ARPA-E focuses on high-risk, high-reward energy technology development. ARPA-E does not fund proposals that are deemed to have low transformational value, meaning incremental improvements on existing technology. ARPA-E does not seek to ascend existing learning curves; rather, ARPA-E seeks to create entirely new learning curves. ARPA-E funds the development of transformational energy technologies that have high technical and financial risks, but where a short-term R&D effort could deliver game-changing results. We set the bar high and build into our funding agreements technical milestones and deliverables that, if met, would not only overcome a specific technical barrier, but also allow a technology to attract future private investment and make progress towards the market.

What fraction of ARPA-E projects must succeed for you to consider ARPA-E itself is a success? One out of every hundred funded projects? Ten out of every hundred? Thirty?

Mr. Majumdar: We define ARPA-E's success by reference to its legislative mandate. ARPA-E will be a success if it enhances the economic and energy security of the United States and ensures that the United States maintains a technological lead in developing and deploying advanced energy technologies. ARPA-E evaluates all of the proposals that it receives to determine whether they will help us achieve these objectives.

ARPA-E focuses on high-risk, high-reward energy technology development, so we expect a substantial percentage of our projects to fail. We will not hesitate to cancel projects and terminate funding where appropriate. It is important to understand that we will learn not only from projects that succeed, but also from projects that "fail." Historically, important scientific and technological knowledge was generated by projects that did not achieve their original objectives. Successful projects incorporate and rely on knowledge obtained through previous, unsuccessful projects. Thus, we expect the United States to benefit from all the projects that we fund, whether they are "successful" or not.

ARPA-E AND DISPLACING PRIVATE SECTOR INVESTMENT

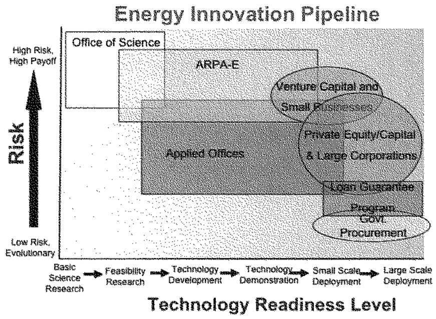
Mr. Majumdar, ARPA-E has been targeting companies that also receive investment from the private sector. This is nothing wrong with this, but it does raise the question of how ARPA-E's scarce dollars can be best used.

Should you be targeting investment opportunities that simply would not happen without your involvement, or should you be working more closely with private sector investors to speed the development of promising technologies?

Mr. Majumdar: At ARPA-E, we seek to make investments in transformational energy technologies that private sector investors would not fund at its present development stage, as well as work with the principal investigator, when appropriate, to help him/her obtain private capital follow-on funding. ARPA-E investments have both high technical risk and high market risk. In some instances, private capital will undertake projects with minimal technical risk, but it is extremely rare for private capital to finance projects that have high technical risk and high market risk. Furthermore, ARPA-E will also make investments in enabling technologies (electric grid, carbon-capture, etc.) that are not attractive for private capital as they are not suitable for a quick return on investment. For the sake of our Nation's technological lead and energy infrastructure, we need to nurture the early-stage work on these types of technologies, which could be later scaled by private investment. ARPA-E realizes that it is critical to examine the entire ecosystem as it will enable and spawn various other technological developments.

We meet and communicate regularly with venture capitalists and other private investors to get a sense of their appetite for risk and the types of projects they are funding and not funding. In addition, I have hired staff with background in the venture capital industry in order to make more precise determinations of the types of high risk projects that are appropriate for ARPA-E to fund.

Let me also explain through the figure below. The DOE Office of Science funds research in basic science and, at times, feasibility of a basic idea or a concept. Private capital is generally available at Technology Readiness Levels when products can be made based on a technology, and customers are ready to buy such products. So from the concept feasibility stage to the product development stage, there exists a big gap today (the so-called "valley of death") where many good ideas perish because the concepts cannot be translated into technologies. When these technologies are disruptive and could make today's approaches obsolete, this translation of ideas to technology is too risky both for the private sector and the applied energy offices in DOE. ARPA-E's goal is to invest in translating such ideas and concepts into disruptive technologies, and make them market ready. Furthermore, ARPA-E will invest in multiple disruptive technological approaches to reach the same goal (e.g., high energy density, low-cost batteries for plug-in hybrid vehicles), and then let the private sector choose the "winning" technology based on what is best for business. Hence, ARPA-E's goal is to reduce technological risks at various stages of developing disruptive technologies.



What are you doing to build relationships with private sector investors, either to ensure you're not displacing investment, or to ensure that you're working to jointly identify promising opportunities?

Mr. Majumdar: We do not anticipate ARPA-E funding to displace private investment, because ARPA-E invests in technologies at a development stage which historically has been too early for private capital. ARPA-E recognizes that private capital is absolutely necessary to ensure commercialization of these early-stage technologies and we continue to strengthen the relationship with the private investment community by publically showcasing our investments. For example, we organized an Energy Innovation Summit on March 1-3, 2010, where ARPA-E award recipients and some companies that were not selected for award had the opportunity to showcase their advanced energy technologies. Approximately 1,700 people attended the Summit, including hundreds of venture capitalists and other private investors. Private investors know that ARPA-E subjects all proposals to rigorous scientific review. Companies that were selected for award by ARPA-E and companies that were selected as finalists during ARPA-E's first funding opportunity are viewed by private investors as having passed muster. In this way, a number of ARPA-E's award recipients and finalists have received follow-on funding from private investors.

We meet and communicate regularly with venture capitalists and other private investors to get a sense of their appetite for risk and the types of projects they are funding and not funding. In addition, I have hired staff with background in the venture capital industry in order to make more precise determinations of the types of high risk projects that are appropriate for ARPA-E to fund.

EARLY- VERSUS LATE-STAGE PROJECTS

I'm told that, of the 37 projects selected for grants in the first round of Recovery Act funding, some selected businesses have already secured venture capital funding.

Isn't the highest value role for ARPA-E to fund ideas that couldn't yet get VC funding precisely because they were still too risky?

Mr. Majumdar: In the first funding opportunity, ARPA-E received proposals from some companies that had already received venture capital funding. However, the venture capital investment was focused on a technology that would lead to quick returns for the investor, but would not be transformational or game changing for the Nation. These companies proposed to ARPA-E new technologies (not the ones for which they received venture funding) that would place them on an entirely new learning curve which, if successful, would indeed be transformational and game-changing. However, these new ideas and concepts were too risky for venture investment and the chances of quick returns (or for that matter, any returns) were much lower. Two examples to illustrate the aforementioned: ARPA-E invested in a completely new technology to substantially reduce the manufacturing cost of photovoltaic cells and a revolutionary design to improve the efficiency of wind turbines, both of which could enable large-scale adoption of solar and wind energy production, respectively. However, the venture investment for these teams was not for this new manufacturing approach, but for a much lower-risk proven approach. Hence, it is important to point out that while ARPA-E has invested in venture-backed companies, the ideas that ARPA-E invested in are not venture backed since they are too risky, but would be game changing if successful.

Why did ARPA-E choose to select these VC-backed projects?

Mr. Majumdar: ARPA-E does not discriminate against companies that may have received private funding in the past. In most cases, the venture capital investment in these companies was focused on a technology that would lead to quick returns for the investor, but would not be transformational or game changing for the Nation. ARPA-E has invested in ideas for radically new technologies by these teams that would place them on an entirely new learning curve which, if successful, would indeed be transformational and game-changing. However, these new ideas are also too risky for venture investment and the chances of quick returns are much lower. For example, ARPA-E has invested in a completely new technology to substantially reduce the manufacturing cost of photovoltaics, which could enable large-scale adoption. However, the venture investment for this team was not for this new manufacturing approach, but for a much lower-risk proven approach. Hence, it is important to point out that while ARPA-E has invested in venture-backed companies, the ideas that ARPA-E invested in are not venture backed since they are too risky, but if successful would be game changing.

ARPA-E does not fund proposals that are deemed to have low transformational value, meaning incremental improvements on existing technology. ARPA-E does not seek to ascend existing learning curves; rather, ARPA-E seeks to create entirely new learning curves. These types of projects have high technical and/or market uncertainty, and are not typically funded by industry.

ARPA-E projects have both high technical risk and high market risk. In some instances, private capital will undertake projects with minimal technical risk, but it is extremely rare for private capital to finance projects that have high technical risk and high market risk. ARPA-E funding will enable the award recipients to take the transformational energy technologies to a stage of reduced technical risk so that private capital will fund it from that point onwards.

Do you expect that ARPA-E will fund venture-backed projects moving forward?

Mr. Majumdar: ARPA-E does not discriminate against companies that may have received private funding in the past. ARPA-E will continue to evaluate and select projects on their merits, with its legislative mandate in mind. That said, ARPA-E is unlikely to support specific projects and ideas in their entirety that have already received venture investment. However, if these companies propose new ideas that are too risky for private investment and that would create an entirely new learning curve which, if successful, would indeed be transformational and game-changing, then ARPA-E would consider funding them after a thorough review process. It is important to point out that while ARPA-E can potentially invest in venture-backed companies, the ideas that ARPA-E invests in are not venture backed since they are too risky, but would be game changing if successful. Pursuant to its statute, ARPA-E prioritizes projects that will enhance the economic and energy security of the United States and ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies. ARPA-E evaluates all of the proposals that it receives to determine whether they will achieve these objectives.

ARPA-E TRANSPARENCY

Mr. Majumdar, as with any new program, ARPA-E has been facing questions about how it does business. You deal with technologies which often aren't well understood, and you're given a great deal of latitude in what you invest in.

How do we outside of the program gain transparency into what you select for investment, and why?

Mr. Majumdar: ARPA-E has made publicly available on its website detailed information on the 37 projects that it is funding (http://www.arpa-e.energy.gov/FundedProjects.aspx). I have explained in detail ARPA-E'S operation and our selection process in my written testimonies. ARPA-E regularly holds public workshops to solicit input on particular technology areas and to provide information on ARPA-E's operations, funding opportunities, and projects. ARPA-E has made publicly available on its website PowerPoint presentations and other materials from these workshops (http://www.arpa-e.energy.gov/ConferencesEvents/PastWorkshops.aspx). ARPA-E also held an Energy Innovation Summit on March 1-3, 2010. The Director of ARPA-E and ARPA-E staff made presentations during the Summit on ARPA-E's operations, funding opportunities, evaluation and selection process, and funded projects. ARPA-E has made publicly available on its website PowerPoint presentations and other materials from the Summit (http://www.arpa-e.energy.gov/ConferencesEvents/InnovationSummitMaterials.aspx).

ARPA-E has made available on its website Frequently Asked Questions on ARPA-E's operations, funding opportunities, projects, and other subjects (http://www.arpa-e.energy.gov/About/FAQs.aspx). We meet and communicate regularly with print and other media, who report on ARPA-E's operations, funding opportunities, projects, and other subjects. In addition, we meet and communicate regularly with venture capitalists, private investors, start-up companies, and others.

Some have suggested that we should organize regional mini-Summits around the country to bring the local technical, entrepreneurial and investment communities together. We are currently considering that idea.

As importantly, how do those who do not succeed in gaining support from your program understand why they were unsuccessful?

Mr. Majumdar: ARPA-E provides applicants with feedback on their submissions. All timely and responsive applications are evaluated by multiple reviewers. The reviewers prepare detailed comments on each application. ARPA-E, in turn, provides these comments to the applicants. ARPA-E also provides applicants with the opportunity to respond to the reviewers' comments.

ARPA-E AND FUNDING MODELS

Mr. Majumdar, when ARPA-E was first proposed, many different funding models were discussed. You received funding in the Recovery Act, and now you're seeking it through regular appropriations, but some wanted you to be funded through revenues from a cap-and-trade program, oil sales revenues, or even oil and gas lease revenues. The theory was that only through such long-term revenue streams would you be able to adequately stimulate innovation.

Do you have any indication that being subjected to regular appropriations processes will stifle your ability to stimulate innovation?

Mr. Majumdar: We do not anticipate that the regular appropriations processes will stifle our ability to stimulate innovation.

If so, how?

Mr. Majumdar: We do not anticipate that the regular appropriations processes will stifle our ability to stimulate innovation.

THE DARPA ANALOGY

We've heard time and time again that ARPA-E is modeled after DARPA and can achieve the same results. However, DARPA was a Defense program and most of its successful projects had a single, monolithic customer: the U.S. military. ARPA-E has a very different challenge, in that it must develop technologies that can compete in the private sector marketplace without demand created solely by the federal government.

How have you thought about ARPA-E differently than DARPA, and how have you modified your implementation of the program to accommodate these important differences?

Mr. Majumdar: At ARPA-E, we view the lack of a monolithic customer (guaranteed buyer) as a challenge and opportunity. Most of the projects that ARPA-E is funding have broad application, meaning the technologies could be used by a wide range of end users in the commercial and government markets. The market size of the commercial and government markets combined is significantly greater than the market size of the U.S. military. We are also in close contact with the military to understand its energy technology needs and how ARPA-E projects could be used to address them. Before we issue a funding opportunity announcement on a particular technology area, we study the technology area in depth. We actively engage the customer base (both private and government) to understand every aspect of the technology area, including performance and cost metrics. Through this process, we develop a clear understanding of the potential market and the end customers. Further, to enable rapid commercial deployment, all ARPA-E programs have very aggressive cost metrics that must be achieved.

PROPOSED PROJECTS IN DECISION SCIENCE FOR BUILDINGS

The budget request includes $30 million for projects focusing on decision science affecting building energy consumption. The Department was provided $22 million in fiscal year 2010 to establish an energy innovation hub focusing on energy efficient building systems.

How are the projects and focus of the ARPA-E proposal different than this energy innovation hub?

Mr. Majumdar: ARPA-E is seeking to develop devices and components for buildings whereas the Energy Efficient Building Systems Design Hub will focus on systems-approach to integration and broader issues. For example, ARPA-E is focusing on energy-efficient cooling technologies and air conditioners for buildings to save energy and reduce greenhouse gas emissions from (1) primary energy consumption due to space cooling and (2) refrigerants used in vapor compression systems. Specifically, ARPA-E is seeking to fund innovative research and development approaches to increase energy efficiency and reduce greenhouse gas emissions due to cooling of buildings in the following areas: (1) cooling systems that use refrigerants with low global warming potential; (2) energy efficient air conditioning systems for warm and humid climates with an increased coefficient of performance (COP); and (3) vapor compression air conditioning systems for hot climates for re-circulating air loads with an increased COP. The unique challenge for the U.S. market is to develop technologies that can be retrofitted into current cooling systems. The development of these technologies will reduce greenhouse gas emissions and significantly increase our country's technological lead in rapidly emerging clean energy industries.

By contrast, the Energy Efficient Building Systems Design Hub will pursue a research, development, and demonstration (RD&D) program that addresses two areas: (1) systems integration of energy technologies in buildings; and (2) economic, policy and behavioral factors influencing building energy consumption. Potential areas of R&D include: energy efficient building materials such as thermoelectrics, low-cost and robust sensor suites, and advanced simulation techniques, as well as tools to integrate building design, construction and operation and capture lifecycle data. Approaches to integrated building design include intelligent zoned heating and cooling, improved air economizers, and integrated approaches to lighting, among others. The Hub will also explore new approaches to building codes, innovations in financial instruments, and research on energy-use behavior. DOE's intent is that this Hub will develop and demonstrate practical, replicable strategies for reducing overall energy consumption in buildings.

With regard to decision science, ARPA-E will focus on developing device level path breaking technologies for decision science whereas the Hub will focus mainly on integration of various devices and system level issues. Therefore, it is very important that ARPA-E buildings and Hub teams work very closely together so that device people are aware of system level/integration challenges and the system people know what kind of next-generation devices might be become available in next few years. This is analogous to the design of a modern day computer. A computer is like a building as it integrates multiple devices such as CPU, graphics, cooling, hard drive, etc. to become fully functional: different companies or groups within a company develop various devices but different cross-organizational/cross-company groups look into system level integration challenges to make sure that these devices result in a fully functional computer. To establish tight linkage between the Hub and ARPA-E, EERE and ARPA-E held a joint buildings workshop in December 2009 so that all involved could discuss both devices level and system level issues and R&D needs.

In summary, ARPA-E is focusing on a narrow device technology area. The Hub has a broader, system-level focus, as described above.

It is helpful to differentiate the missions of ARPA-E and Energy Innovation Hubs on a broad level as well. ARPA-E funds small groups focused on breakthroughs in technology. ARPA-E uses a highly entrepreneurial funding model to support specific new technologies where a short-term R&D effort could deliver game-changing results. By contrast, Energy Innovation Hubs are large, multi-disciplinary, highly collaborative teams of scientists and engineers working over a longer time frame to achieve a specific high priority goal. They are led by top researchers with the knowledge, resources, and authority to nimbly guide efforts, seizing new opportunities or closing off unproductive lines of research.

We don't know where the big energy breakthroughs are going to come from – only what has worked in the past. To reach our energy goals, we must take a portfolio approach to R&D: pursuing several research strategies that have proven to be successful in the past. This work is being coordinated and prioritized, with a 360 degree view of the pieces, and these pieces fit together. Discovering new energy solutions will take smart collaborators pushing the frontiers of science. It will take risk-takers working out of their garages. It will take robust research teams on a mission. And it will take a Department of Energy that brings together the different parts of this research strategy to accelerate the innovation process.

INDUSTRY, UNIVERSITY, OR NATIONAL LAB RECIPIENTS

The first Recovery Act grant solicitation did not allow national labs to take the lead on projects, and of the final selected projects, 35 percent were led by universities and 62 percent by small or large businesses. You have said that the restriction on national laboratories as project leads will be lifted in future rounds.

What proportion of projects do you expect to be led by universities, businesses, or national labs in the remaining Recovery Act rounds, and in future budget requests?

Director Majumdar: ARPA-E has six (6) open funding opportunities at the moment. The percentages for universities, businesses and national labs will depend on the type of funding opportunity, and the technology readiness level it targets. It is difficult to anticipate the percentages at this time. We will report them when we get the final numbers.

For projects led by universities or national labs, what would prevent any resulting innovations from getting stuck "on the shelf" in these research institutions, rather than making it into the market?

Director Majumdar: All ARPA-E funded projects require a 20 percent cost share for the entire project. Since any costs incurred by Federally Funded Research and Development Centers (FFRDCs) are counted toward the Government share (i.e., the share of total project costs borne by the Federal Government), FFRDCs are therefore required to partner with nonprofits, small businesses, and/or large businesses in order to meet the cost-share requirement. Because FFRDCs are required to partner with partners in the private sector, there is much lower risk that transformational technologies developed with ARPA-E funding will get stuck "on the shelf." The FFRDCs' partners in the private sector will have a strong profit incentive to commercialize these technologies and reap the accompanying financial rewards.

Similarly, most educational institutions that apply for ARPA-E funding have partnered with nonprofits, small businesses, and/or large businesses to meet the cost-share requirements. There is minimal risk, then, that transformational technologies developed with ARPA-E funding will get stuck "on the shelf." Educational institutions have taken a leading role in commercializing advanced technologies in recent years. Moreover, the educational institutions' partners in the private sector will have a strong profit incentive to commercialize these technologies and reap the accompanying financial rewards.

In the unlikely event that a transformational technology gets stuck "on the shelf" at a FFRDC or educational institution, the Government has the right under ARPA-E's funding agreements to "march in" and require the licensing the technology at a reasonable royalty rate.

ALLOWING FOR "OUTSIDE OF THE BOX" IDEAS

ARPA-E has developed a "matrix" framework to identify areas of focus for its grant solicitations. We are encouraged that this approach indicates to us that careful thought is going into the direction of ARPA-E projects. However, because this approach means that funding is being driven programmatically against specific problems, it doesn't allow for the crazy idea that doesn't fit in any box.

How will you maintain the possibility of funding those revolutionary ideas that don't fit within your framework or specific areas of focus?

Mr. Majumdar: ARPA-E is open to considering any "out of the box" proposals that do not fit within the parameters of specific funding opportunities. For this reason, ARPA-E has published on its website instructions for the submission of unsolicited proposals (http://arpa-e.energy.gov/About/FAQs.aspx, under "Unsolicited Proposals").

Additionally, ARPA-E plans to hold an open funding opportunity in FY 2011. Like ARPA-E's first funding opportunity, this funding opportunity would be open to any transformational energy technology. In addition, we are investigating different areas on which to focus future funding opportunities, and we are open to all technology areas. We plan to hold workshops on high impact areas to determine if there is a specific technological barrier around which we would structure a future funding opportunity.

PROPOSED 2011 FOCUS AREAS

The budget request includes nine areas of focus for the fiscal year 2011 ARPA-E grants, ranging from materials for industrial power to biological and chemical science for renewable applications.

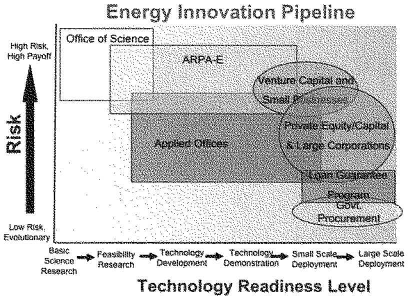
Are there any underlying themes to the nine categories that you can describe, to help us understand the direction that you are proposing to take in 2011?

Mr. Majumdar: We developed these areas of focus based on the information and feedback that we received over the past year. For example, we first reviewed the responses to ARPA-E's first funding opportunity, which was open to all transformational energy technologies, and the types of technologies that were proposed. We then consulted with other government entities, venture capitalists and other private investors, as well as industry. We also reviewed the information and feedback that we received through our public events, including workshops and the Energy Innovation Summit. Furthermore, we have internally coordinated within DOE to identify areas where ARPA-E could add significant value. Through this process, we identified these areas of focus as having "white space" where ARPA-E funding could play a critical role in accelerating the development of transformational energy technologies.

How do these nine focus areas overlap with activities funded in other Department of Energy programs?

Mr. Majumdar: ARPA-E has a fundamentally different mission and function than other Department of Energy programs. ARPA-E focuses on breakthroughs in technologies that are disruptive. ARPA-E funds the development of transformational energy technologies that have high technical and market risks, but where a short-term R&D effort could deliver game-changing results. For example, an ARPA-E project is converting an aluminum manufacturing process into a liquid metal battery for grid-level electricity storage – this approach is too application-oriented for DOE's Office of Science and perhaps too high risk for DOE's applied energy offices. This is what we define as the ARPA-E "white-space."

Let me also explain through the figure below. DOE's Office of Science funds research based on basic science and, at times, the feasibility of a basic idea or a concept. Private capital is generally available at Technology Readiness Levels when products can be made based on a technology, and customers are ready to buy such products. Therefore, from the concept feasibility stage to the product development stage, a big gap exists today where many good ideas perish because the concepts cannot be translated into technologies. When these technologies are disruptive and could make today's approaches obsolete, this translation of ideas to technology is too risky both for the private sector and the applied energy offices in DOE. ARPA-E's goal is to invest in translating such ideas and concepts into disruptive technologies, and make them market ready.



Before we issue a funding opportunity announcement on a particular technology area, we study the technology area in depth. We actively engage the customer base to understand every aspect of the technology area, including performance and cost metrics. Through this process, we develop a clear understanding of the potential market and the end customers. As part of this process, we consult closely with other DOE offices and programs to avoid any duplication or redundancy. We engage members of other DOE offices in ARPA-E workshops, defining the funding opportunity announcements, and proposal review process.

To improve coordination within DOE, I have formed a Panel of Senior Technical Advisors (PASTA) for ARPA-E. PASTA consists of Assistant Secretaries (or their Technical Appointees) of all the relevant applied energy offices as well as the heads of all the relevant offices in the Office of Science. The purpose of ARPA-E is to coordinate and leverage each of its programs and also to ensure that ARPA-E provides unique value within the DOE. In addition, I coordinate very closely with Under Secretaries Johnson and Koonin, as well as the Director of the Office of Science, Bill Brinkman. It is through such coordination and close interactions that all of the six ARPA-E programs were created. I should also add that before I joined ARPA-E, Under Secretaries Johnson and Koonin played a very critical hands-on role in getting ARPA-E off the blocks and running during the first funding opportunity.

It is helpful to differentiate the missions of ARPA-E, Energy Frontier Research Centers, and Energy Innovation Hubs on a broad level as well. As stated previously, ARPA-E funds small groups focused on breakthroughs in technology. ARPA-E uses a highly entrepreneurial funding model to support specific new technologies where a short-term R&D effort could deliver game-changing results. By contrast, Energy Innovation Hubs are large, multi-disciplinary, highly collaborative teams of scientists and engineers working over a longer time frame to achieve a specific high priority goal. They are led by top researchers with the knowledge, resources, and authority to nimbly guide efforts, seizing new opportunities or closing off unproductive lines of research. Energy Frontier Research Centers are small groups of researchers focused on breakthroughs in science. They are mostly university-led teams working to solve the specific scientific problems that are blocking clean energy development.

We don't know where the big energy breakthroughs are going to come from – only what has worked in the past. To reach our energy goals, we must take a portfolio approach to R&D: pursuing several research strategies that have proven to be successful in the past. This work is being coordinated and prioritized, with a 360 degree view of the pieces, and these pieces fit together. Discovering new energy solutions will take smart collaborators pushing the frontiers of science. It will take risk-takers working out of their garages. It will take robust research teams on a mission. And it will take a Department of Energy that brings together the different parts of this research strategy to accelerate the innovation process.

What areas of focus that you have considered and conspicuously lack funding are not included in your request? Why not?

Mr. Majumdar: Before we issue a funding opportunity announcement on a particular technology area, we study the technology area in depth. We actively engage the customer base to understand every aspect of the technology area, including performance and cost metrics. Through this process, we develop a clear understanding of the potential market and the end customers. As part of this process, we consult closely with other DOE offices and programs.

Not all technology areas that we study result in the issuance of a funding opportunity announcement. We may determine that a funding opportunity would be unlikely to produce significant gains in energy efficiency, significant reductions in energy-related emissions, or significant reductions in imports of energy from foreign sources. Alternatively, we may determine that there is insufficient "white space" where ARPA-E funding could play a critical role in accelerating the development of transformational energy technologies. For example, we held a workshop on energy from wastewater in January 2010. Subsequently, we determined that further study was required before issuing a funding opportunity announcement in this area.

JOBS CREATED THROUGH ARPA-E WITH RECOVERY ACT FUNDING

Mr. Majumdar, ARPA-E received $400 million in the stimulus Act. How many jobs have you created with Recovery Act dollars?

Mr. Majumdar: Although the America COMPETES Act authorized the establishment of ARPA-E in 2007, no money was appropriated to ARPA-E, and ARPA-E did not come into existence until April 2009. For its first funding opportunity, ARPA-E evaluated over 3,700 proposals, and selected only 37 proposals for award. Over 500 scientists and engineers from academia and industry participated in the merit review of concept papers and full applications. By the conclusion of the merit review process, nearly 11,500 reviews had been completed. ARPA-E negotiated funding agreements with the 37 award recipients through February 2010. As part of the ARRA requirements, ARPA-E is expecting its award recipients to report data on jobs created.

It is important to note that the intent of ARPA-E investments is to innovate and create disruptive technologies that could be game-changing and have very large and positive impacts on our society. However, these technologies are likely to take more than 10 years to scale to this level of impact. But when they scale, they will ensure a US technological lead and numerous American jobs. One should also note that the first investment that DARPA made to create the ARPANET (the precursor of the Internet) in 1968 led to only a few jobs in the early 1970s. It took about 15 years for the network to scale and, as we now know, has led to numerous jobs. When ARPA-E investments produce such "home runs," it is fair to expect that many jobs will be created, but one should not expect such numerous jobs in the next two to three years. It is likely to take more than 10 years for this to result.

When jobs are created, what proportion is likely to be overseas, since that's where much of the high-tech manufacturing is today?

Mr. Majumdar: ARPA-E requires small businesses to manufacture substantially in the United States any products used or sold in the United States that embody subject inventions (i.e., inventions that were first conceived or reduced to practice under the award). If the small business or a university or National Laboratory assigns or exclusively or licenses intellectual property rights relating to the subject inventions, the assignees or licensees are required to manufacture substantially in the United States any products used or sold in the United States that embody the subject inventions.

ARPA-E requires large businesses to manufacture substantially in the United States any products that embody subject inventions, whether they are used and sold in the United States or overseas. If the large business assigns or licenses intellectual property rights relating to the subject inventions, the assignees or licensees are required to manufacture substantially in the United States any products that embody subject inventions, whether they are used and sold in the United States or overseas.

In the above circumstances, an award recipient and ARPA-E for good cause shown may negotiate alternate legal obligations that provide a net benefit to the U.S economy.

These requirements exceed any requirements for domestic manufacturing contained in any statute such as are found in the Bayh-Dole Act and or any other related federal laws, or DOE regulations. They are reflective of DOE policy choices intended to maximize the benefit to the U.S. economy, and policies.

FIRST ROUND RECOVERY ACT PROJECTS

ARPA-E awarded $151 million to 37 projects in its first round of Recovery Act funding. We are keenly interested in how this first round of projects goes, as it is the program's inaugural batch of programs.

Of these 37 awards, how many contracts have been finalized and signed?

Mr. Majumdar: ARPA-E has finalized and signed funding agreements for all of the 37 projects that were selected during ARPA-E's first funding opportunity. ARPA-E finalized and signed 40 percent of the funding agreements within two months of the award announcement, 95 percent within ten weeks, and 100 percent within three months. ARPA-E finalized and signed the last of the 37 funding agreements in February 2010.

How many projects have begun their research and development work?

Mr. Majumdar: All of the 37 projects that were selected during ARPA-E's first funding opportunity have begun their research and development work.

For the projects that do not have signed contracts, what factors are holding them back?

Mr. Majumdar: ARPA-E has finalized and signed funding agreements for all of the 37 projects that were selected during ARPA-E's first funding opportunity.

REMAINING RECOVERY ACT FUNDS

Of the remaining Recovery Act funds for ARPA-E, how much has been announced in grant solicitations and when will those projects be announced?

Mr. Majumdar: ARPA-E currently has six open funding opportunities– three in Funding Opportunity Announcement Round 2 and three in Funding Opportunity Announcement Round 3. We are in the process of reviewing full applications for the three funding opportunities included in Round 2. We expect to announce the award winners by May 2010 and award approximately $100 million of Recovery Act funds through these three funding opportunities. We are reviewing concept papers for the other three funding opportunities included in Round 3. We expect to announce those award winners in June 2010 and will award approximately $100 million of Recovery Act funds through these three funding opportunities.

When will funding solicitations for the remaining balance of Recovery Act funding be announced?

Mr. Majumdar: We do not plan to issue any further funding solicitations beyond the funding opportunities that have already announced. We plan to award the balance of Recovery Act funds through the above-referenced funding opportunities.

THE USE OF "OTHER TRANSACTION" AUTHORITY

I understand that ARPA-E used "other transaction" authority in three cases as it wrote contracts for recent awards. In doing so, the Department gave up intellectual property and other contract rights to these three grant recipients that it is normally not permitted to give up.

Given the sheer number of qualified applications that ARPA-E received for these solicitations, why were these three projects so important that subverting the regular contract and intellectual property agreement process was justified, rather than simply choosing one of the other highly-qualified applicants that did not receive funding?

Mr. Majumdar: The Energy Policy Act of 2005 includes provisions to address the Nation's long-term energy challenges. To provide DOE with more flexibility to enter into agreements with private-sector entities, section 1007 of the Energy Policy Act of 2005 granted the Secretary of Energy authority to enter into transactions (other than standard contracts, grants, and cooperative agreements), subject to the same terms and conditions as the Secretary of Defense under section 2371 of title 10, United States Code. This authority, similar to that previously authorized for the Departments of Defense and Homeland Security, allows an agency to enter into agreements that are not subject to other Federal laws and regulations governing contracts, grants or cooperative agreements.

This "other transactions authority" provides a tool to DOE to provide for more flexible terms and conditions, and thereby enhance the Federal Government's ability to acquire or support cutting-edge science and technology by attracting nontraditional government contractors or by allowing the Federal Government to obtain the participation of an essential contractor who otherwise would not participate in a particular program. As required by the Energy Policy Act of 2005, DOE developed and issued final regulations to implement other transactions authority before using the authority. Furthermore, DOE issued supplemental guidance and developed and presented training on how to use the other transactions authority to DOE legal, procurement, and program office officials. DOE decided to implement other transactions authority by using a special type of financial assistance instrument, called Technology Investment Agreements (TIAs). The Government Accountability Office reviewed DOE's regulations and initial TIA award and concluded that "the controls DOE put into place over the use of its other transactions authority appear to be adequate, assuming that DOE continues to effectively implement the safeguards and to incorporate lessons learned as the department negotiates future agreements."

Following an evaluation of 3,700 concept papers and a rigorous evaluation of 312 full applications, ARPA-E selected the 37 best applications. ARPA-E simply identified the best ideas, and funded those ideas regardless of the source (e.g., small business, educational institution, nonprofit, or large business).

Congress vested in ARPA-E a demanding mandate to enhance the economic and energy security of the United States and to ensure that the United States maintains a technological lead in developing and deploying advanced energy technologies. Implicit in this mandate was the idea that ARPA-E should not settle for second-best ideas. In fact, the concept of ARPA-E was patterned after DOD's DARPA, which was a frequent user of other transactions authority. Additionally, the ARPA-E agreements did not subvert the regular Government process with respect to intellectual property and other contract rights. Instead, the process was highly competitive and, before approving modifications to the standard IP provisions, ARPA-E took into account those Government policies and assured that any modifications were minimal and counterbalanced by other benefits to the country obtained through the participation of the awardees in the ARPA-E program. This careful approach is demonstrated by the actual negotiations and resulting agreement which I will now describe.

All ARPA-E awardees were presented with DOE's standard provisions applicable to cooperative agreements. In addition, as part of the intellectual property provisions, all ARPA-E awardees, like awardees under other DOE programs, were required to agree to special U.S. competitiveness provisions that exceeded any statutory or regulatory requirements, addressing obligations to manufacture in the United States any new technology arising from an award, or to provide some other net benefit, approved by DOE, to the U.S. economy. These special U.S. competitiveness provisions allow an awardee to request modification in the future for good cause. With the assistance of IP counsel and a contracting officer, ARPA-E negotiated three Technology Investment Agreements. In so doing ARPA-E, and by extension DOE, followed applicable law, regulation, and policy. Before negotiating with any of those requesting a TIA, the companies had to meet the regulatory requirements to obtain changes to any of the standard provisions that are not normally available to recipients of cooperative agreements. In all three TIAs entered into by ARPA-E, the only such provisions that were modified were the intellectual property provisions. Among the requirements for a TIA, each TIA recipient was required to cost share at least 50 percent instead of a minimum of 20 percent required of other ARPA-E recipients.

FloDesign Wind Turbine Corp. (FloDesign), a small business cost-sharing 50 percent, was selected for an ARPA-E award to further develop a high-efficiency, shrouded wind turbine design that it had been initially developing at private expense. Foro Energy, another small business cost-sharing 50 percent, has created or conceived selected specialized drilling technology at private expense. DuPont was selected for an ARPA-E award to explore the production of isobutanol, an alternate fuel for combustion engines, from algae. FloDesign, Foro Energy and DuPont were concerned that some of their technology, although conceived before the ARPA-E award, may be "first actually reduced to practice" under their awards, thus bringing the technology under the definition of a "subject invention" under DOE's statutory patent policy. While the awardees could elect ownership of "subject inventions," the inventions would be subject to certain statutory terms and conditions that apply to "subject inventions," including a free license for Government purposes, and "march-in rights." They were also similarly concerned about DOE's requirements related to manufacture of new technology in the U.S. These reserved Government rights would be an encumbrance that would inhibit their efforts to raise private risk capital in the future or inhibit their ability to commercialize technology in technical areas that were not the subject of the ARPA-E award.

After negotiation, DOE agreed to modify the application of march-in rights and the reserved Government license by allowing FloDesign and Foro Energy the option, in the future, to buy back the reserved Government license and march-in rights, which are required by statute on other than a TIA, in any subject inventions by repaying any Federal funds received under the award, plus interest, and by further agreeing to forego any further Federal funding under the award. The purpose of the march-in rights provision, which potentially allows DOE to require an awardee to license subject inventions to competitors if an awardee is not taking effective steps to commercialize a subject invention, is to assure that Government-funded technology is commercialized. In DOE's view, if a company is willing in the future to repay the initial Government investment, then that company has a commitment to commercialize the technology demonstrated by making such a payment. DOE did not agree to any change to the U.S. manufacture requirements, except that for FloDesign, DOE agreed that if FloDesign made a future request to modify the U.S. competitiveness clause, DOE agreed to issue a written determination granting or denying the request within 90 days.

DuPont was concerned about exposing its previously developed IP to Government rights. The previously developed IP arose from substantial prior investment by DuPont and their partners in exploring the production of isobutanol from feedstocks other than algae. If not given the opportunity to negotiate Government rights of a different scope, DuPont would not participate in the project. ARPA-E determined it essential to have DuPont become part of the program because the DuPont technology was unique and promised, if successful, a transformative advance in renewable energy. However, in order to merit consideration for a TIA, DuPont was required to increase its proposed cost sharing from 25 percent to 50 percent.

After negotiation, DOE agreed that march-in rights and the reserved Government license would not apply to DuPont inventions that had been conceived prior to the ARPA-E award. March-in rights and the reserved Government license would apply to inventions conceived in the performance of the ARPA-E award but only in the field of the production of butanol and isomers thereof, including isobutanol, from macroalgae. DOE believes that the goal of the march-in right provision is met because the substantial private investment that has been made by DuPont makes it likely that it, if anyone, will commercialize the technology and, if it does not, no one else will likely want to commercialize the technology. However, U.S competitiveness provisions attach to ***all*** subject inventions, whether they were conceived and reduced to practice in the performance of the ARPA-E award or just inventions conceived in the performance of the ARPA-E award. DOE also agreed that the U.S. competiveness provision would apply only in the field of the production of butanol and isomers thereof, including isobutanol, from macroalgae. This field limitation is consistent with DOE's flexible approach in general in applying U.S competitiveness provisions in DOE applied research awards.

What did you give away in these contract negotiations using the "other transaction" authority, and what did you gain?

Mr. Majumdar: The previous answer provides a detailed description of the negotiation process and the agreement that resulted from that process for each of the 3 "other transactions."

STATUS OF HIRING FOR KEY STAFF POSITIONS

We hear that ARPA-E is taking great care to hire program directors who are experts in their field, for short terms at ARPA-E. Further, as you portray the organization, the success of the program depends on experience, expertise, and general quality of the people in these positions.

Have you completed hiring all program directors you plan to hire?

Mr. Majumdar: We are continuing to recruit additional program directors. By law, the terms of program directors are limited to three years, although the term may be renewed. Because the terms of program directors are limited, ARPA-E intends to solicit applications for program director positions on a rolling basis.

How many have been hired, how many remain to be brought on, and when will your program director hiring be completed?

Mr. Majumdar: We are continuing to recruit additional program directors. By law, the terms of program directors are limited to three years, although the term may be renewed. Because the terms of program directors are limited, ARPA-E intends to solicit applications for program director positions on a rolling basis.

To date, we have hired six program directors. Three of the program directors administer the 37 projects that were selected through ARPA-E's first funding opportunity, and oversee three current funding opportunities that are due to announce their selections in April 2010. Another three program directors were hired in March 2010. These program directors oversee three current funding opportunities that are due to announce their selections in June 2010.

ARPA-E will require additional program directors to administer the awards issued in the coming months, develop new technology development programs, and further the ARPA-E's legislative mandate. ARPA-E expects to have 10-15 program directors, though the number may vary over time.

Since program directors have limited terms—perhaps three years—you can expect many of them to leave. I can imagine it will be a real challenge to hire experts of the same caliber every several years. What is your plan to maintain quality at the program director level knowing that you expect frequent turnover in these positions?

Mr. Majumdar: We are continuing to recruit additional program directors. By law, the terms of program directors are limited to three years, although the term may be renewed. Because the terms of program directors are limited, ARPA-E intends to solicit applications for program director positions on a rolling basis. We are continuing to receive a large number of applications from leading scientists and researchers. In addition, we are reaching out to the best and brightest in different scientific and technical fields, and will continue to do so in the coming years. We are also reaching out to leading universities, nonprofits, and other organizations to encourage them to contribute their most talented researchers for limited-term appointments at ARPA-E.

UP-FRONT FUNDING OF CONTRACTS

ARPA-E grants under the Recovery Act are fully funded up-front—that is, the recipients receive the entire amount of their grant commitment when they are awarded the grant. ARPA-E has told us that it does not intend to fully fund grants awarded with fiscal year 2011 funds, but instead the full grant for each recipient would depend on future fiscal year appropriations.

What led you to take this approach for fiscal year 2011 funding?

Mr. Majumdar: For projects funded under the Recovery Act, ARPA-E obligated the entire amount of the cooperative agreement commitment for each project. The recipients did not receive the entire amount, per se, as they still have to invoice ARPA-E for reimbursement of allowable costs incurred in executing the cooperative agreement. Costs that are not allowable under the cooperative agreement will not be reimbursed, and if a project is not meeting its technical milestones and deliverables the project would be halted and the remaining funds deobligated.

We managed the Recovery Act funding in this way for several reasons. First, the budget authority to obligate Recovery Act funding expires at the end of FY 2010; so we needed to ensure that all of the Recovery Act funds appropriated to ARPA-E were obligated before that expiration. We had to choose whether to obligate funds to cover all three years of a smaller number of projects, or just the first year of a larger number of projects. The reason we chose the former is that as a new organization we did not have the staff, structure, or processes in place to manage effectively the larger number of projects that would have resulted from obligating funds to cover just the first year of projects.

For fiscal year 2011 funding we plan to obligate funding on our cooperative agreements in amounts that would cover some period of time less than the full duration of the agreement – perhaps an amount enough to reach the first technical milestone go/no-go decision point. After consulting many people we decided to manage the regular appropriations in this manner for several reasons. First, we are not facing the same restrictions on the timing of the obligation of funds as we had under the Recovery Act so we are able to choose the manner we think is best for the program. We now have the staff, structure, and processes in place to manage a larger number of projects at one time. Also, this approach will enable us to have greater flexibility in the use of appropriated funds. We do not want to obligate the full amount of awards because a substantial percentage of our projects are likely to be canceled for failure to meet the aggressive technical milestones and deliverables. Not having to go through the deobligation process will allow us to move funding more rapidly to other projects. Having this more flexible approach to funding projects in place will allow us to better achieve our legislative mandate.

Will this approach have a chilling effect on applications if applicants fear they may not receive the entire grant in future years?

Mr. Majumdar: We do not expect this approach to have any adverse effects on future funding opportunities. There is tremendous interest and enthusiasm for ARPA-E's funding opportunities. This interest and enthusiasm is not contingent on the obligation of the full amount of the award upon the signing of the funding agreement.

Conversely, will this approach make it easier to cancel underperforming projects?

Mr. Majumdar: We do not expect this approach to have any effect on the process for canceling projects. We already have a rigorous process for assessing recipients' progress. We measure each recipient's progress against a set of aggressive milestones and deliverables. We will not be shy about canceling projects and terminating funding, where appropriate.

PROGRAM DIRECTION FUNDING IN 2011 REQUEST

The request for program direction is roughly the same as that allocated from within Recovery Act funds.

Have you reached a sufficient staffing level with the Recovery Act and fiscal year 2009 funds, and do you plan to maintain that staffing level, increase it, or decrease it in fiscal year 2011?

Mr. Majumdar: We have not reached a sufficient staffing level yet. We plan to increase our staffing in FY 2011. We will require additional staff as we issue more awards, administer more projects, develop more technology development programs, and release more funding opportunities.

ISOTOPES

Mr. Simpson: Undersecretary Koonin, I know you share my great concern with the problem we are facing regarding the lack of domestic sources for medical isotopes. In the recent hearing with NNSA, they mentioned that they are seeking non-HEU based technologies to address this shortfall since they do not pose a proliferation threat. I belive [*sic*] that DOE should have a balanced approach to this issue by looking at both accelerators, which do not create HEU as well as reactors as potential production sources, The being said, what is the Office of Science doing to pursue research in compact-accelerator isotope production with national labs, universities and the private sector?

Mr. Koonin: The National Nuclear Security Administration (NNSA) has the lead within the Department of Energy for the establishment of a domestic supply of molybdenum-99 (Mo-99). It is presently providing funding for R&D targeted to develop the capability for commercial production of Mo-99 using low enriched uranium adequate to meet domestic demand by December 31, 2013. Four technology solutions, including particle accelerator technology are being pursued. The Nuclear Physics program has substantial expertise in accelerator technology, operating four accelerator-based national user facilities for basic research and two accelerator-based facilities for isotope production. The Nuclear Physics program has been working closely with NNSA, providing technical and project management support as appropriate.

The FY 2011 Nuclear Physics budget request includes funding for research and development efforts to develop new production and processing techniques of radioisotopes, an effort initiated when the Isotope Program was transferred from the Office of Nuclear Energy to the Office of Science in FY 2009. The effort considers both accelerator and reactor-based production techniques for isotopes within the program portfolio. Awards in FY 2009 and FY 2010 were competitive and based on merit peer review, with priorities for isotope production guided by recommendations from the Nuclear Science Advisory Committee (NSAC). The Isotope Program is also conducting pre-conceptual R&D on stable isotope production techniques, as recommended by NSAC.

Mr. Simpson: Will this research help ensure a diverse and reliable supply for medical providers?

Mr. Koonin: The research on isotope production and processing techniques being conducted by the Office of Science and support of new production techniques for Mo-99 being conducted by the National Nuclear Security Administration will help insure a diverse and reliable supply for medical providers.

Mr. Simpson: Will this help expand the supply of new isotopes that are currently unavailable or in short supply?

Mr. Koonin: Research on new or improved isotope production and processing techniques is expanding the supply of new isotopes that are currently unavailable or in short supply. The focus of the new research initiative conducted by the Nuclear Physics Isotope Program is to target isotopes which are currently unavailable or in short supply and identify technological advances that will enable their production.

WITNESSES

	Page
Brinkman, William	353
Geiser, David	1
Hoffman, P. A	143
Johnson, Kristina	143
Koonin, Steven	353
Majumdar, Arun	353
Markowsky, James	143
Triay, Ines	1
Zoi, Cathy	143